US006442691B1

(12) **United States Patent**
Blandford

(10) **Patent No.: US 6,442,691 B1**
(45) **Date of Patent: Aug. 27, 2002**

(54) **AUTHENTICATED TIME DEVICE**

(76) Inventor: **Robert Roy Blandford**, 1809 Paul Spring Rd., Alexandria, VA (US) 22307

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **08/394,954**

(22) Filed: **Feb. 27, 1995**

Related U.S. Application Data

(60) Division of application No. 08/198,041, filed on Feb. 17, 1994, which is a division of application No. 08/020,354, filed on Feb. 22, 1993, now Pat. No. 5,347,579, which is a continuation-in-part of application No. 07/637,675, filed on Jan. 7, 1991, now Pat. No. 5,189,700, which is a continuation-in-part of application No. 07/375,502, filed on Jul. 5, 1989, now abandoned.

(51) **Int. Cl.**[7] **H04K 1/00**; H04K 9/00; G07D 7/00

(52) **U.S. Cl.** **713/178**; 340/5.8; 380/51

(58) **Field of Search** ..... 380/25, 23, 45, 380/30, 51; 395/425; 364/DIG. 1, DIG. 2; 340/825.34, 5.8; 713/178

(56) **References Cited**

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5,150,407	A *	9/1992	Chan	380/4

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G. J. Popek et al, Computing Surveys, vol. 11 #4, Dec. 1979, p. 339.*

Central Point: Mac Tool Deluxe, Central Point Software, Inc.; Beaverton, OR; 1991; pp. 131–146 of Manual.*

Apple Macintosh System Software 6.0; Apple Computer, Inc.; 1988; Cupertino, CA; pp. 86–89, 117, 119, 120 of User's Guide.*

* cited by examiner

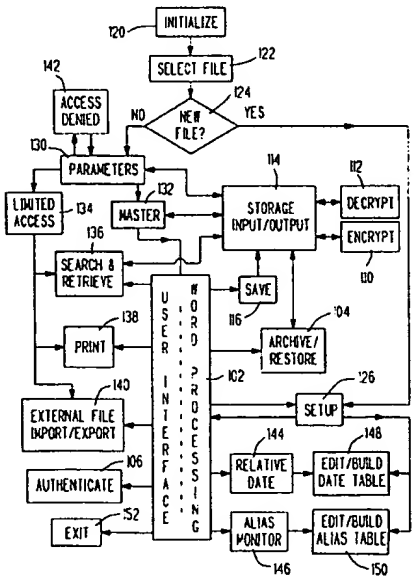
Primary Examiner—Stephen C. Buczinski
(74) *Attorney, Agent, or Firm*—Donald W. Marks

(57) **ABSTRACT**

A computer diary archives a diary entry by creating, time stamping, authenticating and permanently storing a reference data block along with each diary entry. An archived diary entry can only be modified by placing original text within compartment codes, such as cross-out or tear-out codes, and by placing inserted text within insertion codes so that the original diary entry can be recreated from the modified diary entry. The reference data block, which can be the original diary entry, a canonical version of the original diary entry, or a one way fixed length encryption (hash) of the original diary entry, cannot be modified and is used to authenticate the original diary entry.

The diary program also monitors text entry for aliases and relative date phrases, and upon detection, prompts the user for entry or enters a specific identifier for each detected alias in an alias compartment or an absolute date for each relative date phrase in an implied date compartment in the diary entry.

64 Claims, 18 Drawing Sheets



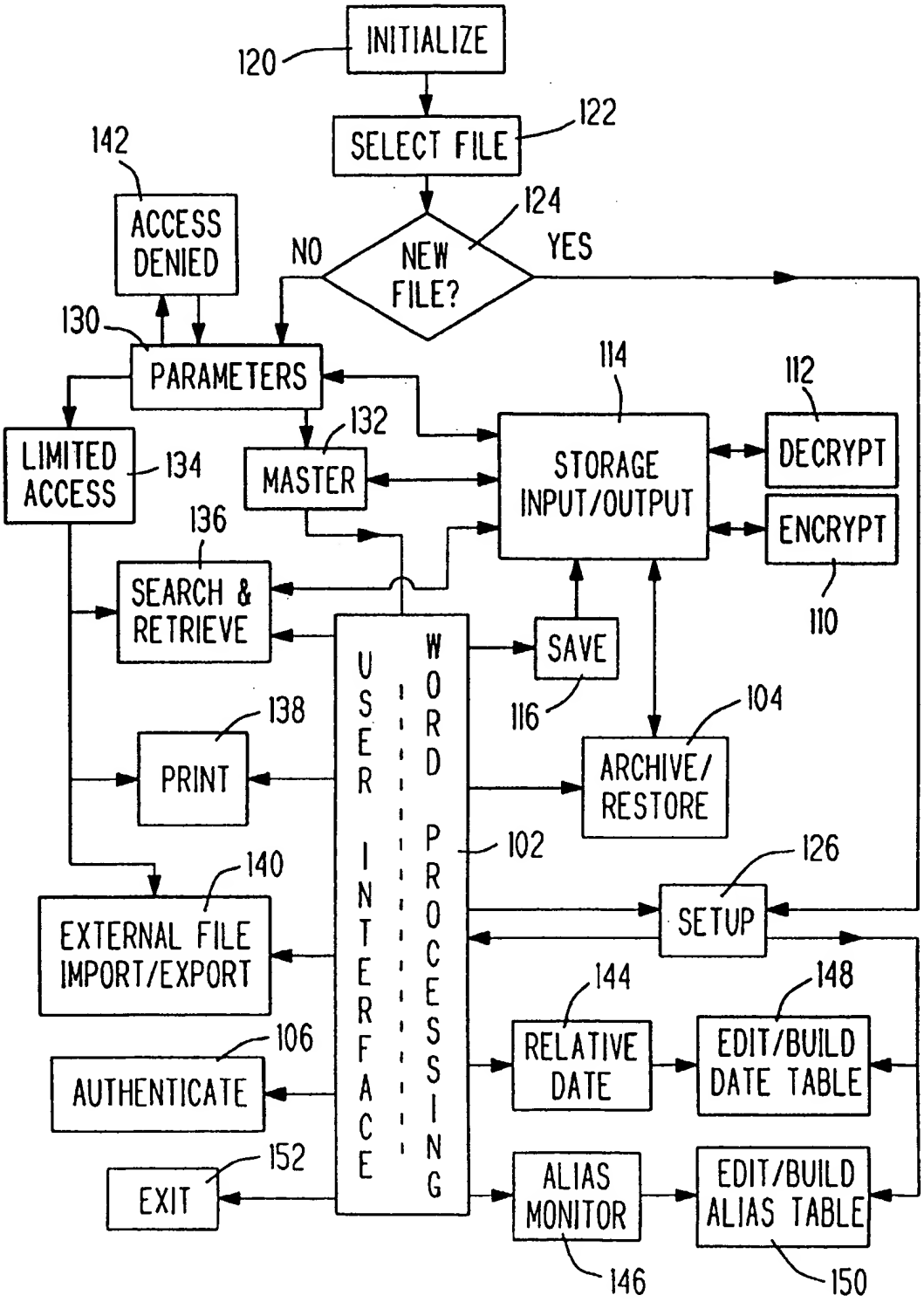

INITIALIZE
120
SELECT FILE
122
142
ACCESS DENIED
124
NEW FILE?
NO
YES
130
PARAMETERS
114
112
LIMITED ACCESS
134
132
MASTER
STORAGE INPUT/OUTPUT
DECRYPT
ENCRYPT
110
136
SEARCH & RETRIEVE
SAVE
116
104
ARCHIVE/ RESTORE
138
PRINT
USER INTERFACE
WORD PROCESSING
102
126
SETUP
140
EXTERNAL FILE IMPORT/EXPORT
144
148
RELATIVE DATE
EDIT/BUILD DATE TABLE
106
AUTHENTICATE
152
EXIT
ALIAS MONITOR
EDIT/BUILD ALIAS TABLE
146
150

FIG. 1

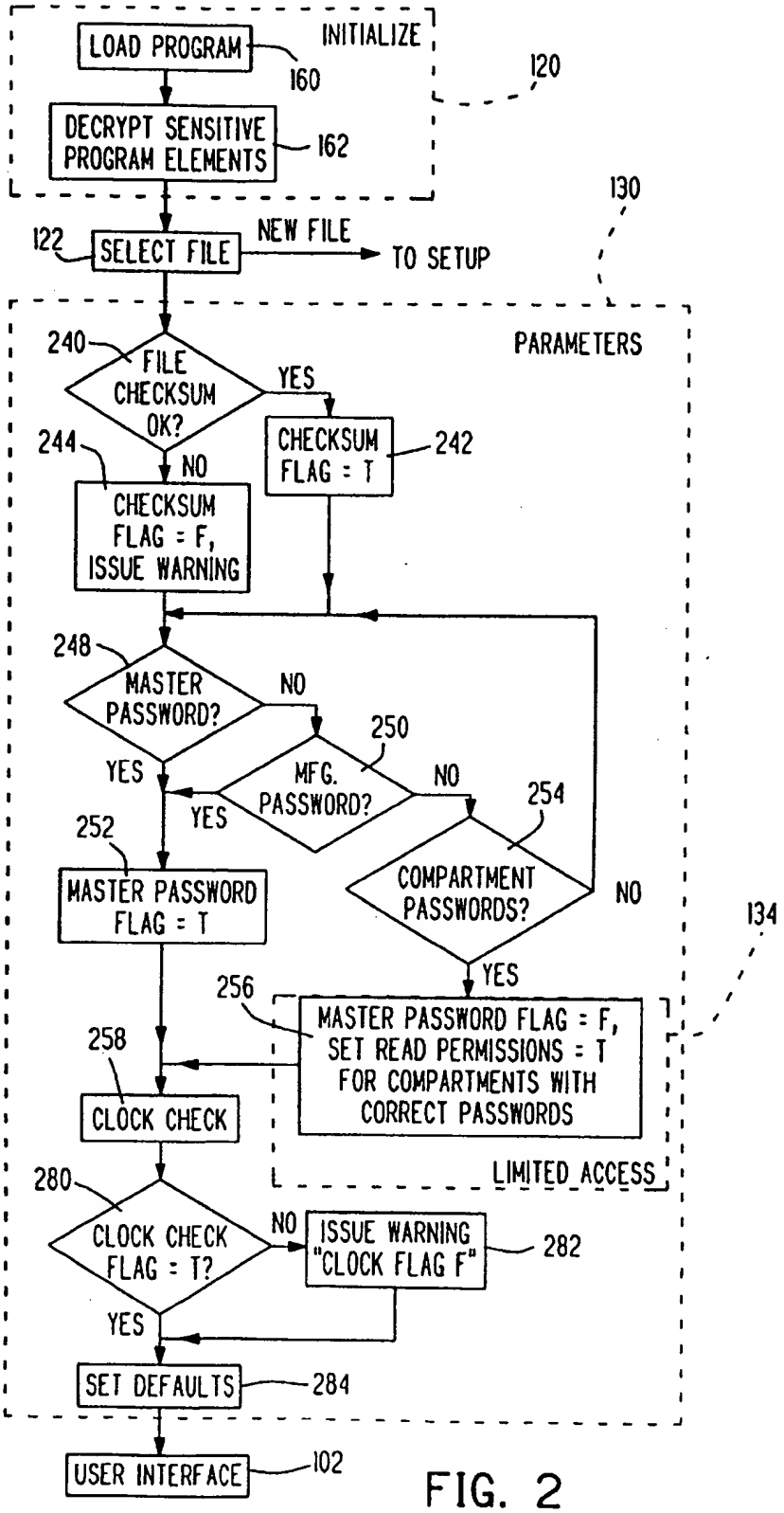

INITIALIZE
LOAD PROGRAM
160
DECRYPT SENSITIVE PROGRAM ELEMENTS
162
120
130
122
SELECT FILE
NEW FILE
TO SETUP
PARAMETERS
240
FILE CHECKSUM OK?
YES
CHECKSUM FLAG = T
242
244
NO
CHECKSUM FLAG = F, ISSUE WARNING
248
MASTER PASSWORD?
NO
250
MFG. PASSWORD?
YES
NO
YES
254
252
COMPARTMENT PASSWORDS?
NO
MASTER PASSWORD FLAG = T
YES
134
256
MASTER PASSWORD FLAG = F, SET READ PERMISSIONS = T FOR COMPARTMENTS WITH CORRECT PASSWORDS
258
CLOCK CHECK
LIMITED ACCESS
280
CLOCK CHECK FLAG = T?
NO
ISSUE WARNING "CLOCK FLAG F"
282
YES
SET DEFAULTS
284
USER INTERFACE
102

FIG. 2

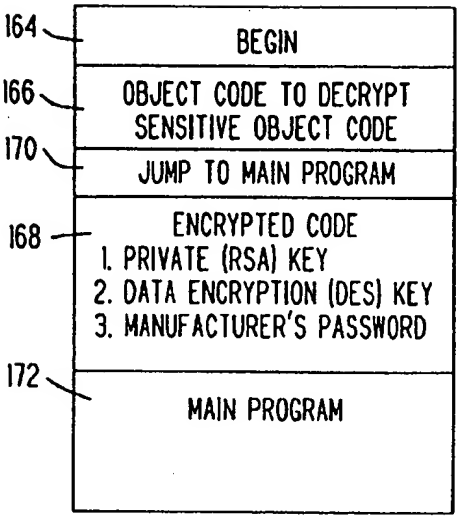

164
BEGIN
166
OBJECT CODE TO DECRYPT SENSITIVE OBJECT CODE
170
JUMP TO MAIN PROGRAM
168
ENCRYPTED CODE
1. PRIVATE (RSA) KEY
2. DATA ENCRYPTION (DES) KEY
3. MANUFACTURER'S PASSWORD
172
MAIN PROGRAM

FIG. 3

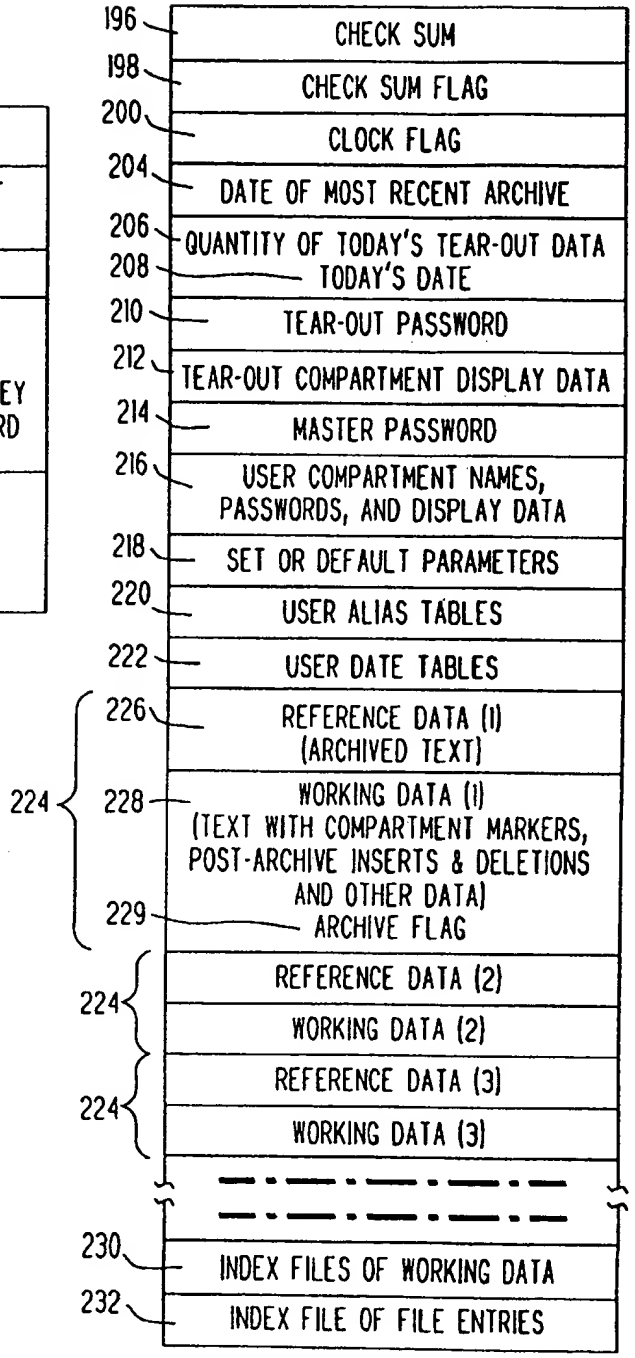

196
CHECK SUM
198
CHECK SUM FLAG
200
CLOCK FLAG
204
DATE OF MOST RECENT ARCHIVE
206
QUANTITY OF TODAY'S TEAR-OUT DATA
208
TODAY'S DATE
210
TEAR-OUT PASSWORD
212
TEAR-OUT COMPARTMENT DISPLAY DATA
214
MASTER PASSWORD
216
USER COMPARTMENT NAMES, PASSWORDS, AND DISPLAY DATA
218
SET OR DEFAULT PARAMETERS
220
USER ALIAS TABLES
222
USER DATE TABLES
224
226
REFERENCE DATA (1) (ARCHIVED TEXT)
228
WORKING DATA (1) (TEXT WITH COMPARTMENT MARKERS, POST-ARCHIVE INSERTS & DELETIONS AND OTHER DATA)
229
ARCHIVE FLAG
224
REFERENCE DATA (2)
WORKING DATA (2)
224
REFERENCE DATA (3)
WORKING DATA (3)
230
INDEX FILES OF WORKING DATA
232
INDEX FILE OF FILE ENTRIES

FIG. 4

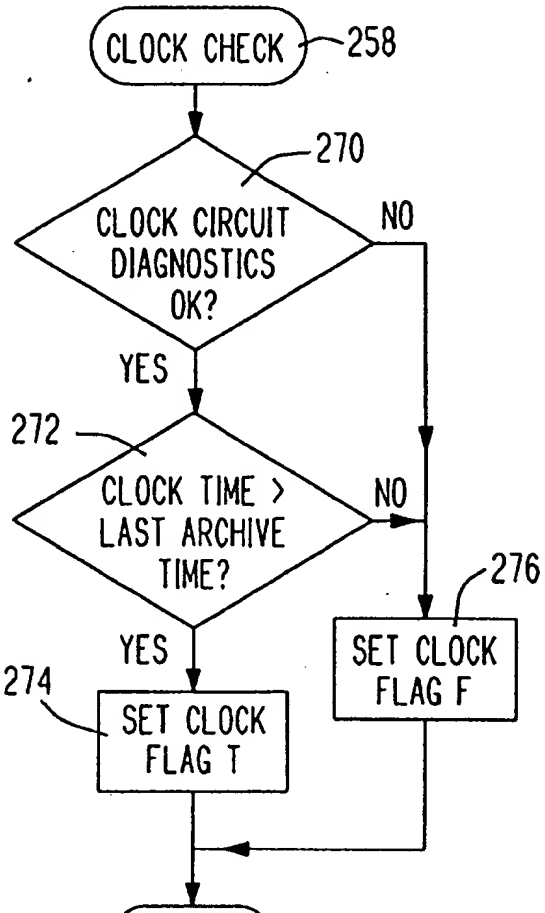

CLOCK CHECK
258
270
CLOCK CIRCUIT DIAGNOSTICS OK?
NO
YES
272
CLOCK TIME > LAST ARCHIVE TIME?
NO
YES
276
SET CLOCK FLAG F
274
SET CLOCK FLAG T
RETURN

FIG. 5

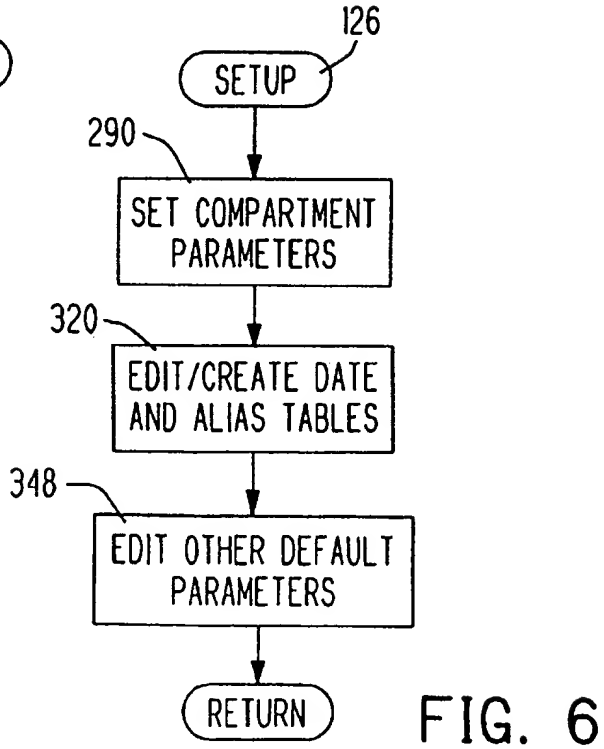

126
SETUP
290
SET COMPARTMENT PARAMETERS
320
EDIT/CREATE DATE AND ALIAS TABLES
348
EDIT OTHER DEFAULT PARAMETERS
RETURN

FIG. 6

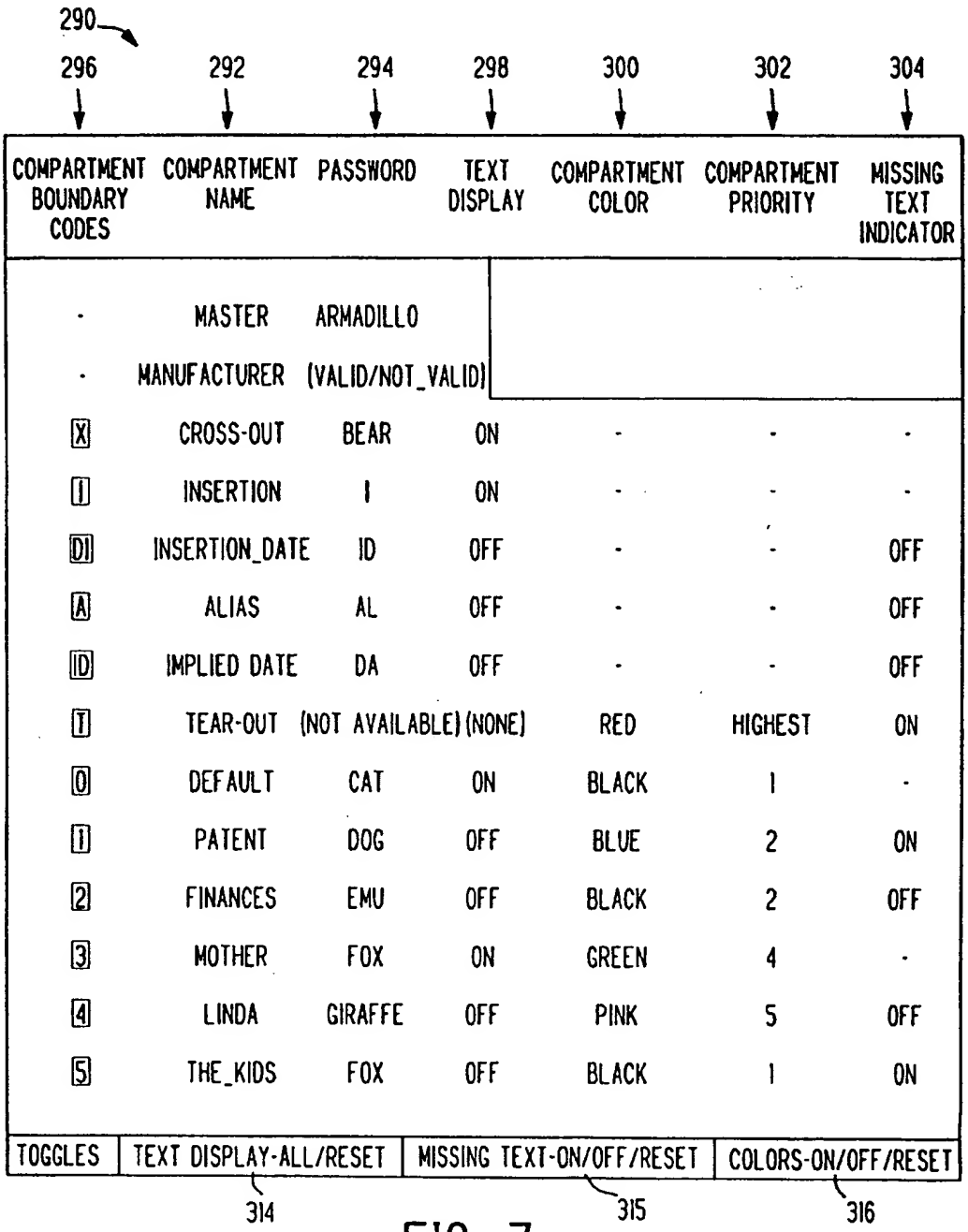

290
296
292
294
298
300
302
304
COMPARTMENT BOUNDARY CODES
COMPARTMENT NAME
PASSWORD
TEXT DISPLAY
COMPARTMENT COLOR
COMPARTMENT PRIORITY
MISSING TEXT INDICATOR
MASTER
ARMADILLO
MANUFACTURER
(VALID/NOT_VALID)
X
CROSS-OUT
BEAR
ON
I
INSERTION
I
ON
DI
INSERTION_DATE
ID
OFF
A
ALIAS
AL
OFF
ID
IMPLIED DATE
DA
OFF
T
TEAR-OUT
(NOT AVAILABLE)
(NONE)
RED
HIGHEST
ON
0
DEFAULT
CAT
ON
BLACK
1
1
PATENT
DOG
OFF
BLUE
2
ON
2
FINANCES
EMU
OFF
BLACK
2
OFF
3
MOTHER
FOX
ON
GREEN
4
4
LINDA
GIRAFFE
OFF
PINK
5
OFF
5
THE_KIDS
FOX
OFF
BLACK
1
ON
TOGGLES
TEXT DISPLAY-ALL/RESET
MISSING TEXT-ON/OFF/RESET
COLORS-ON/OFF/RESET
314
315
316

FIG. 7

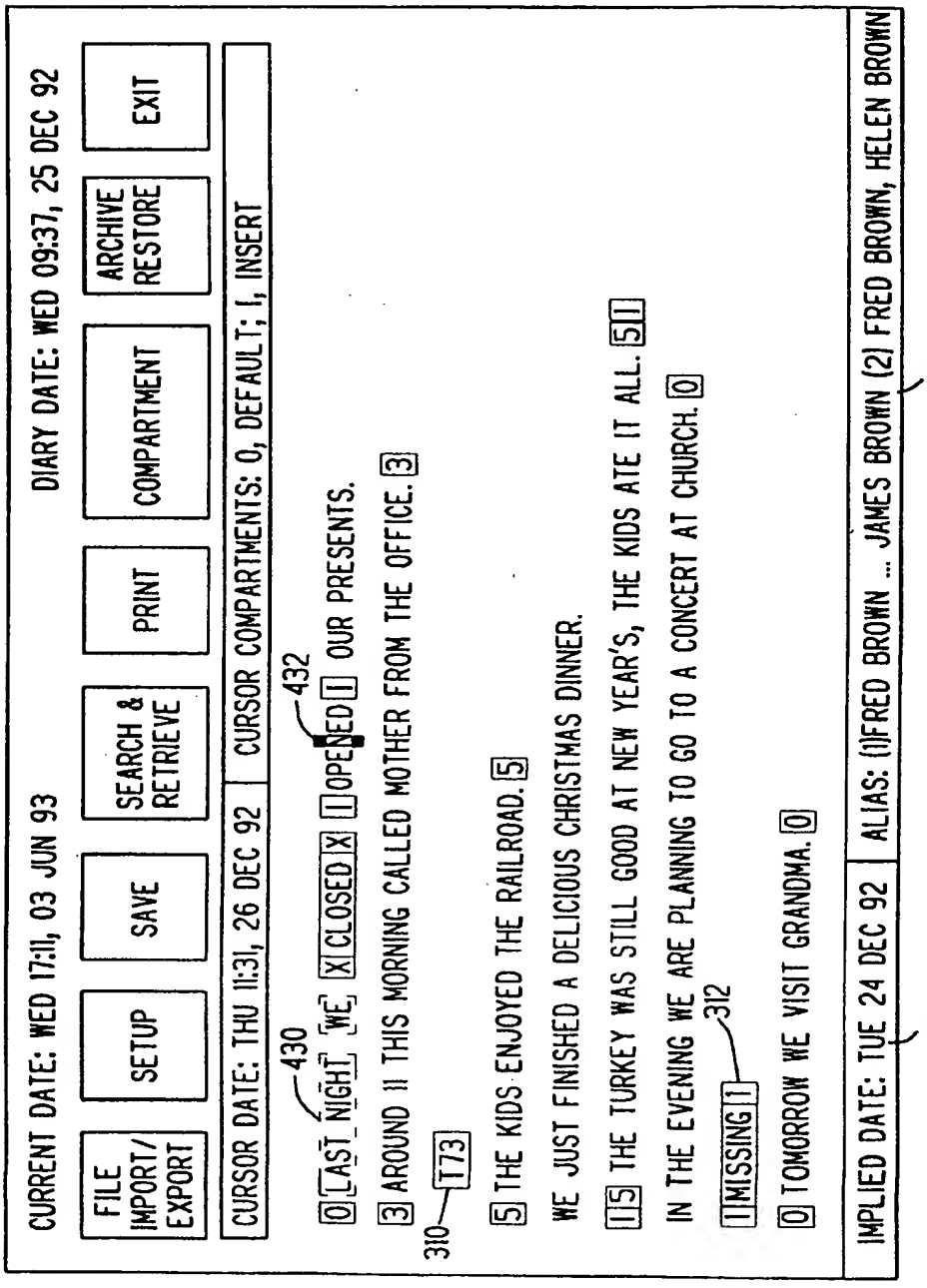

CURRENT DATE: WED 17:11, 03 JUN 93
DIARY DATE: WED 09:37, 25 DEC 92
FILE IMPORT/ EXPORT
SETUP
SAVE
SEARCH & RETRIEVE
PRINT
COMPARTMENT
ARCHIVE RESTORE
EXIT
CURSOR DATE: THU 11:31, 26 DEC 92
CURSOR COMPARTMENTS: 0, DEFAULT; 1, INSERT
430
0 LAST NIGHT WE, X CLOSED X 1 OPENED 1 OUR PRESENTS.
432
3 AROUND 11 THIS MORNING CALLED MOTHER FROM THE OFFICE. 3
310
T73
5 THE KIDS ENJOYED THE RAILROAD. 5
WE JUST FINISHED A DELICIOUS CHRISTMAS DINNER.
1 5 THE TURKEY WAS STILL GOOD AT NEW YEAR'S, THE KIDS ATE IT ALL. 5 1
IN THE EVENING WE ARE PLANNING TO GO TO A CONCERT AT CHURCH. 0
312
1 MISSING 1
0 TOMORROW WE VISIT GRANDMA. 0
IMPLIED DATE: TUE 24 DEC 92
ALIAS: (1)FRED BROWN ... JAMES BROWN (2) FRED BROWN, HELEN BROWN
418
442

FIG. 8

322

DATE PHRASE (324)	REFERENCE DATE (326)	FORMULA NUMBER (328)
YESTERDAY	(NONE)	1
LAST NIGHT	(NONE)	1
TOMORROW	(NONE)	2
DAY BEFORE YESTERDAY	(NONE)	3
TWO DAYS AGO	(NONE)	3
. . .	. . .	.
. . .	. . .	.
FIVE DAYS AGO	(NONE)	6
LAST THANKSGIVING	(NONE)	7
NEXT THANKSGIVING	(NONE)	8
LAST CHRISTMAS	DEC 25	9
NEXT CHRISTMAS	DEC 25	10
LAST XMAS	DEC 25	10
LAST NEW YEARS	JAN 1	9
NEXT NEW YEARS	JAN 1	10
LAST WEEK ON MONDAY	(NONE)	11
. . . . .	. .	.

BUILT-IN DATE WORD-PHRASE TABLE

FIG. 9

222

DATE PHRASE	REFERENCE DATE	FORMULA NUMBER
MY NEXT BIRTHDAY	JAN 4	10
MY LAST BIRTHDAY	JAN 4	9
BILL'S NEXT BIRTHDAY	DEC 21	10
BILL'S LAST BIRTHDAY	DEC 21	9
MY NEXT ANNIVERSARY	MAY 1	10
OUR LAST ANNIVERSARY	MAY 1	9
. . .	. . .	.

USER'S WORD PHRASE TABLE

FIG. 10

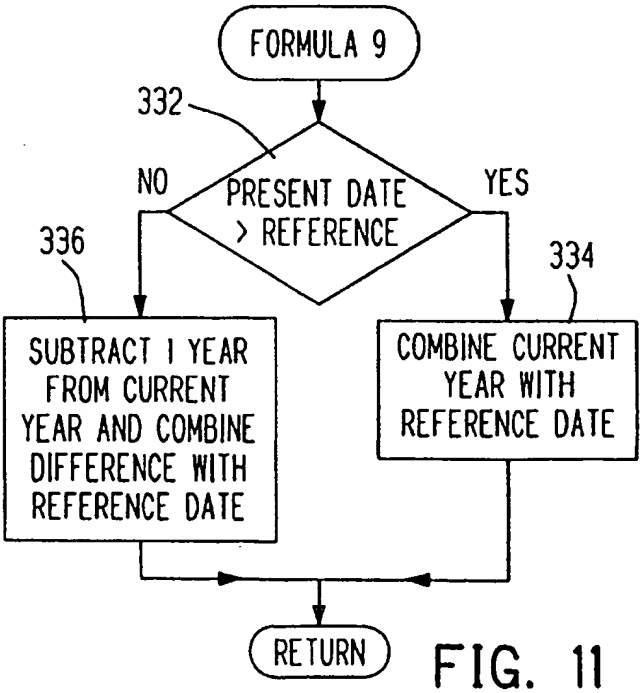


FIG. 11

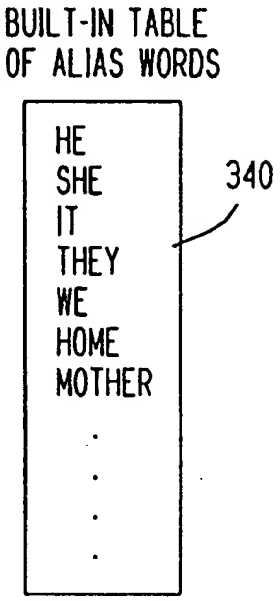


FIG. 12

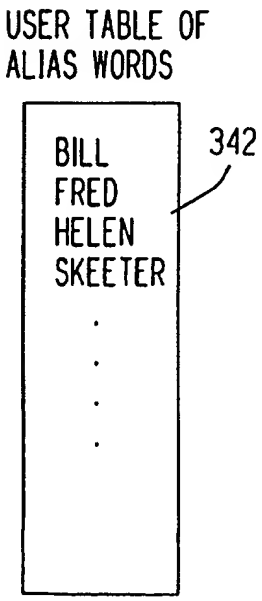


FIG. 13

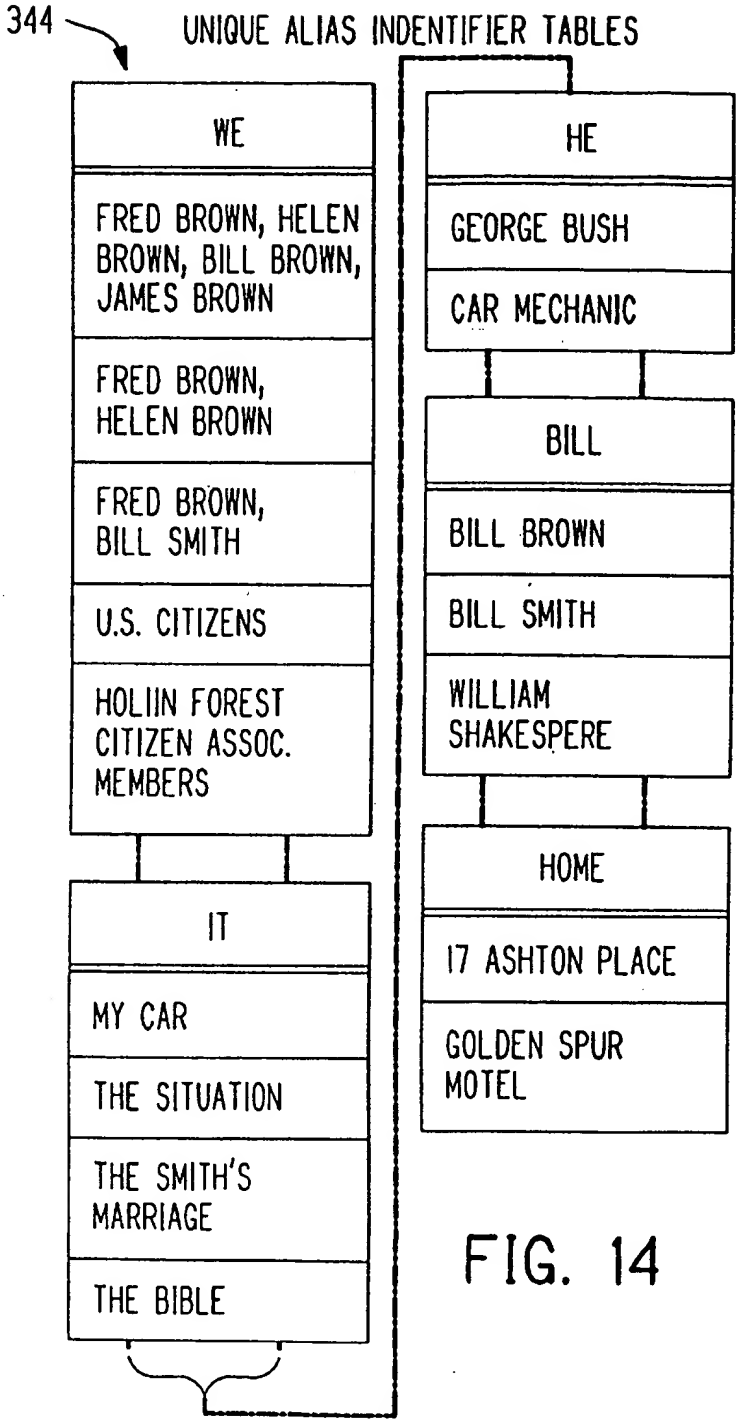


FIG. 14

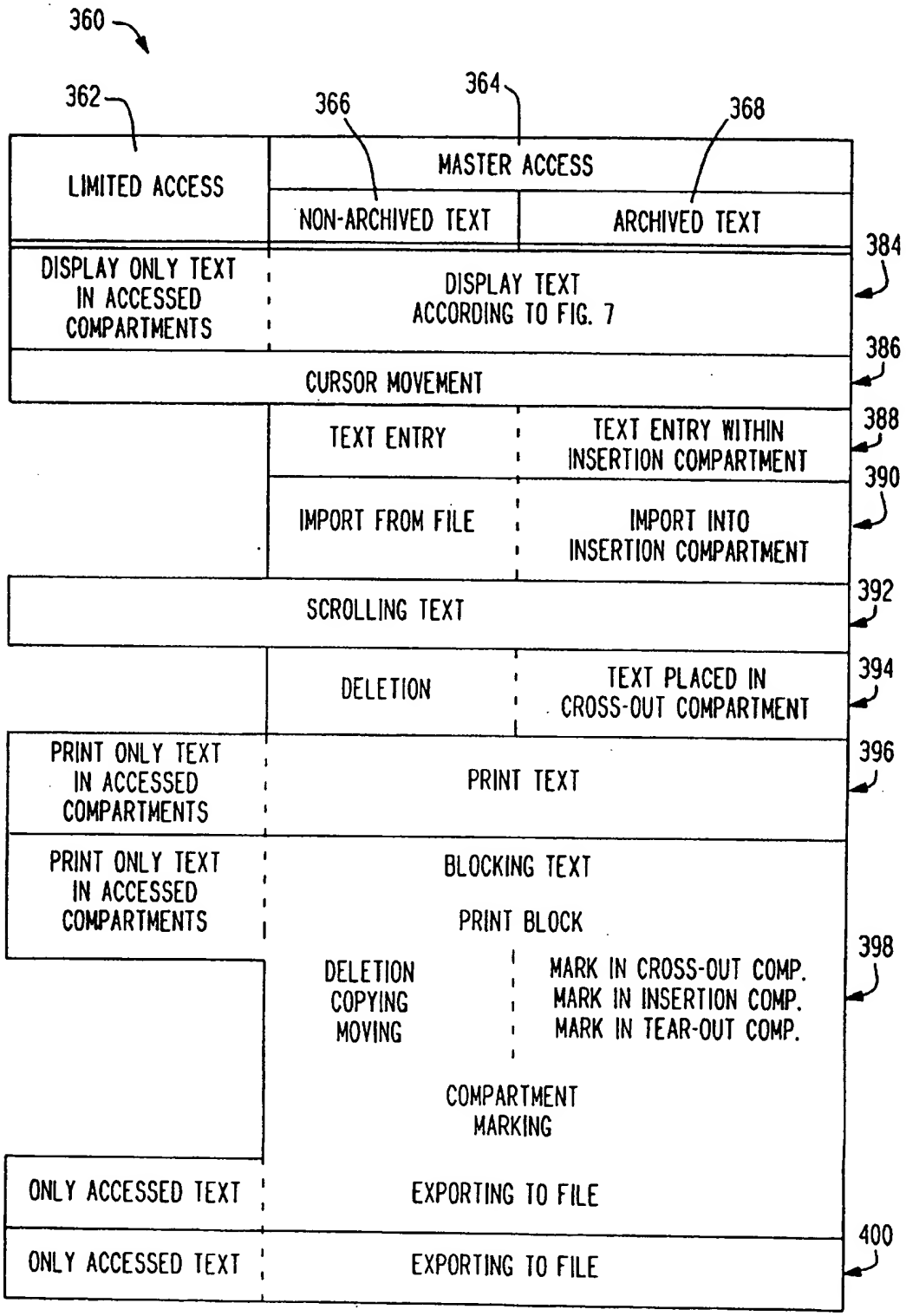

360
362
364
366
368
LIMITED ACCESS
MASTER ACCESS
NON-ARCHIVED TEXT
ARCHIVED TEXT
DISPLAY ONLY TEXT IN ACCESSED COMPARTMENTS
DISPLAY TEXT ACCORDING TO FIG. 7
384
CURSOR MOVEMENT
386
TEXT ENTRY
TEXT ENTRY WITHIN INSERTION COMPARTMENT
388
IMPORT FROM FILE
IMPORT INTO INSERTION COMPARTMENT
390
SCROLLING TEXT
392
DELETION
TEXT PLACED IN CROSS-OUT COMPARTMENT
394
PRINT ONLY TEXT IN ACCESSED COMPARTMENTS
PRINT TEXT
396
PRINT ONLY TEXT IN ACCESSED COMPARTMENTS
BLOCKING TEXT
PRINT BLOCK
DELETION
COPYING
MOVING
MARK IN CROSS-OUT COMP.
MARK IN INSERTION COMP.
MARK IN TEAR-OUT COMP.
398
COMPARTMENT MARKING
ONLY ACCESSED TEXT
EXPORTING TO FILE
ONLY ACCESSED TEXT
EXPORTING TO FILE
400

FIG. 15

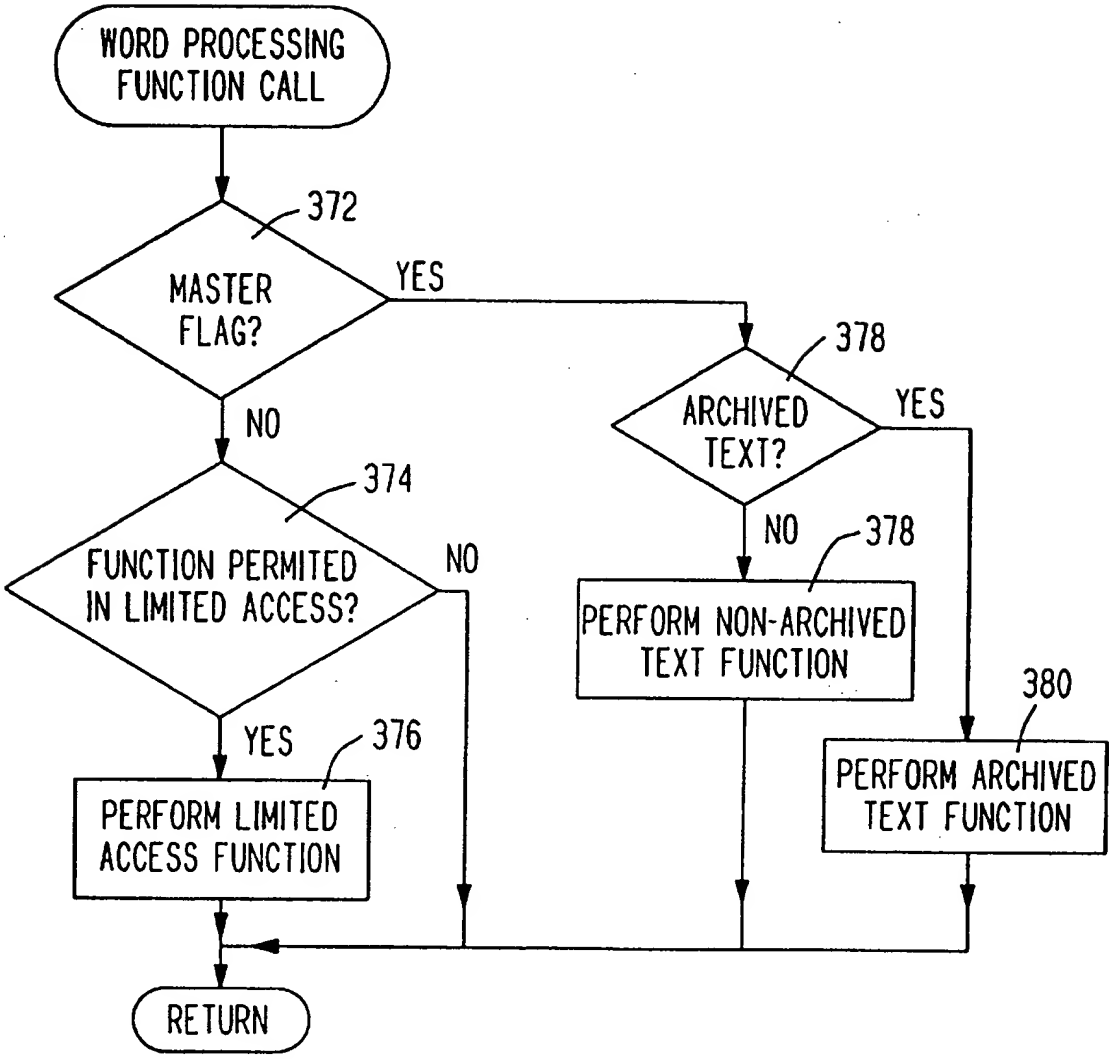

WORD PROCESSING FUNCTION CALL
372
MASTER FLAG?
YES
NO
374
FUNCTION PERMITED IN LIMITED ACCESS?
NO
YES
376
PERFORM LIMITED ACCESS FUNCTION
378
ARCHIVED TEXT?
YES
NO
378
PERFORM NON-ARCHIVED TEXT FUNCTION
380
PERFORM ARCHIVED TEXT FUNCTION
RETURN

FIG. 16

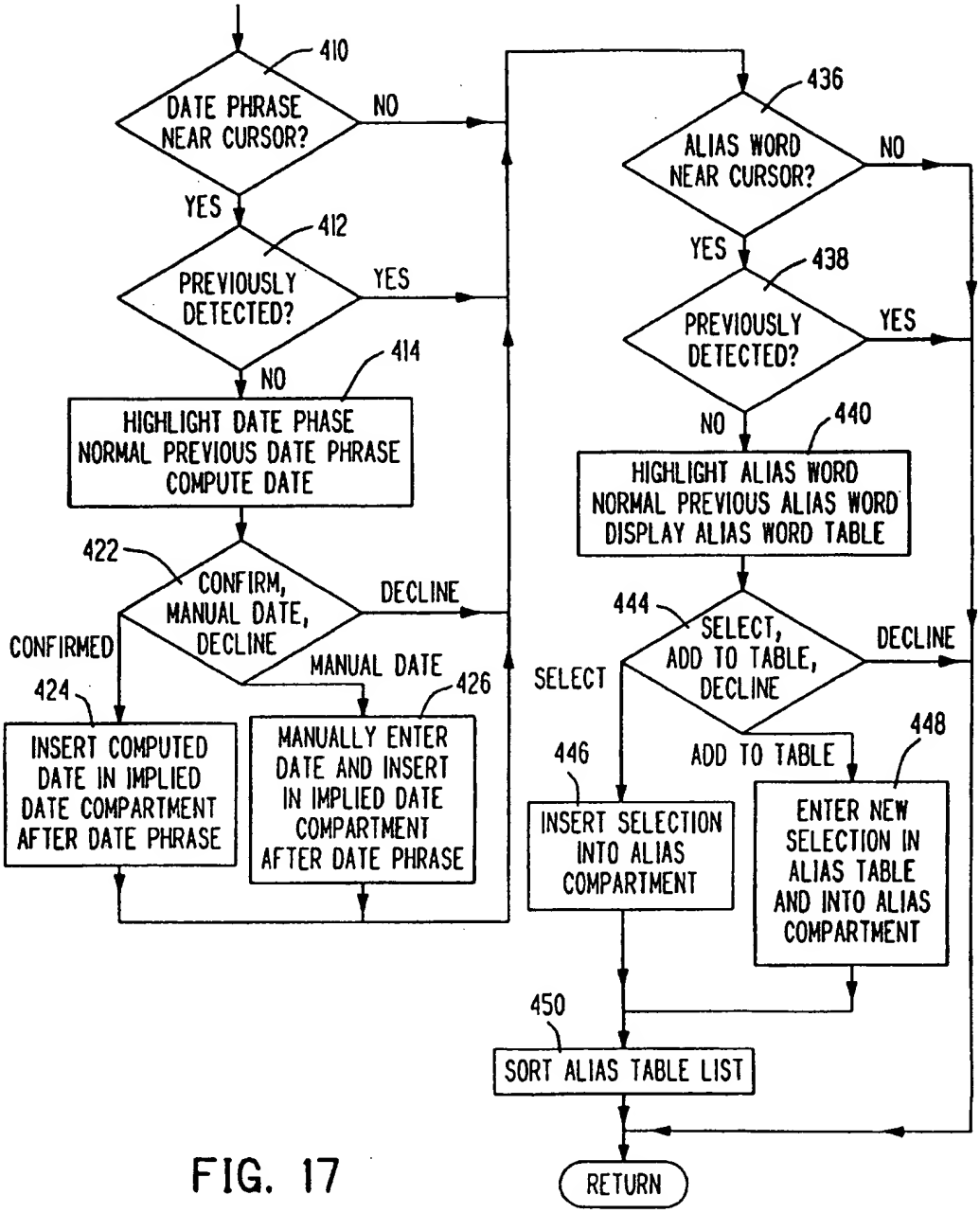

410
DATE PHRASE NEAR CURSOR?
NO
YES
412
PREVIOUSLY DETECTED?
YES
NO
414
HIGHLIGHT DATE PHASE NORMAL PREVIOUS DATE PHRASE COMPUTE DATE
422
CONFIRM, MANUAL DATE, DECLINE
DECLINE
CONFIRMED
MANUAL DATE
424
INSERT COMPUTED DATE IN IMPLIED DATE COMPARTMENT AFTER DATE PHRASE
426
MANUALLY ENTER DATE AND INSERT IN IMPLIED DATE COMPARTMENT AFTER DATE PHRASE
436
ALIAS WORD NEAR CURSOR?
NO
YES
438
PREVIOUSLY DETECTED?
YES
NO
440
HIGHLIGHT ALIAS WORD NORMAL PREVIOUS ALIAS WORD DISPLAY ALIAS WORD TABLE
444
SELECT, ADD TO TABLE, DECLINE
DECLINE
SELECT
ADD TO TABLE
446
INSERT SELECTION INTO ALIAS COMPARTMENT
448
ENTER NEW SELECTION IN ALIAS TABLE AND INTO ALIAS COMPARTMENT
450
SORT ALIAS TABLE LIST
RETURN

FIG. 17

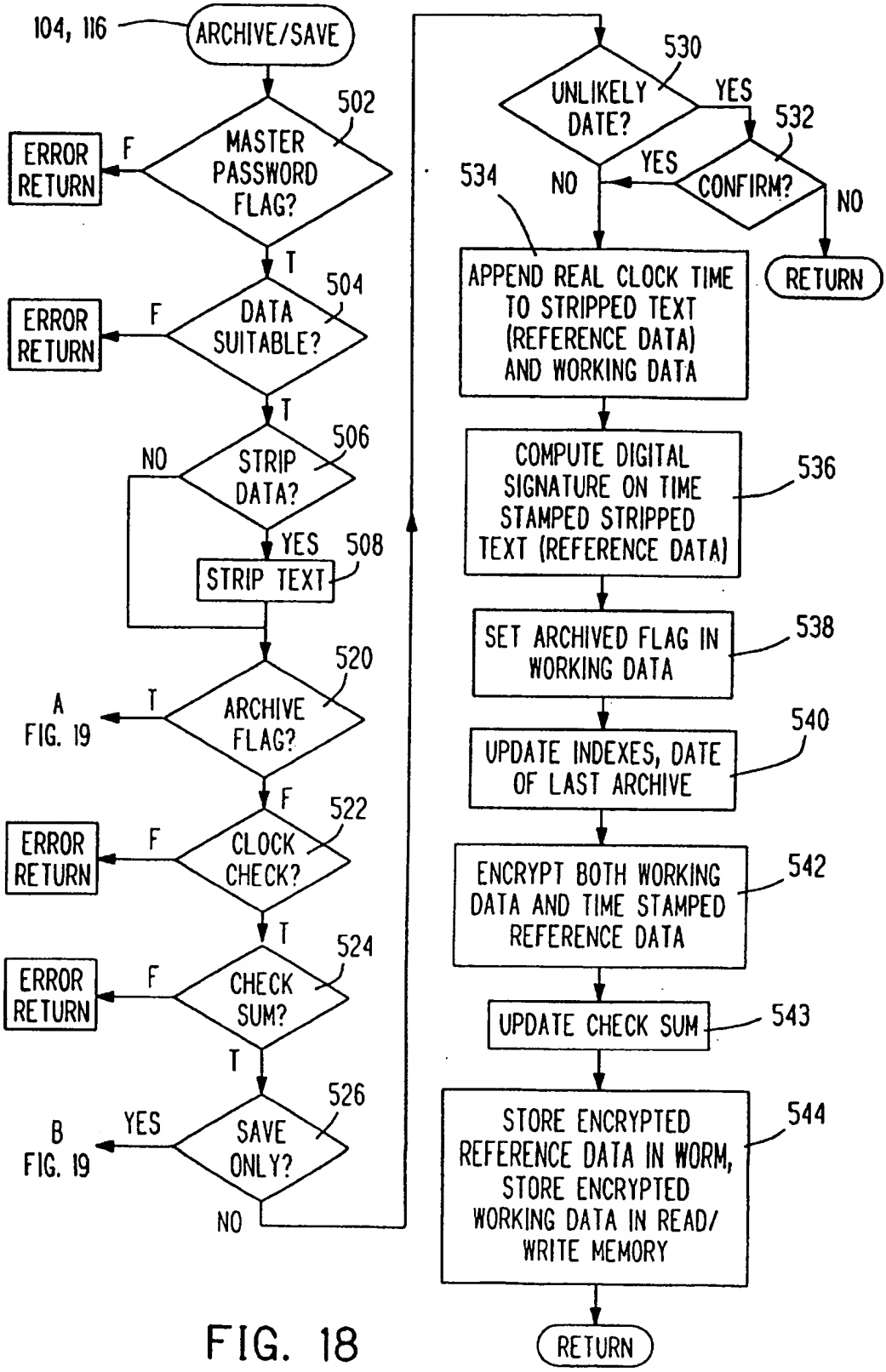

104, 116
ARCHIVE/SAVE
502
MASTER PASSWORD FLAG?
F
ERROR RETURN
T
504
DATA SUITABLE?
F
ERROR RETURN
T
506
STRIP DATA?
NO
YES
508
STRIP TEXT
520
ARCHIVE FLAG?
T
A FIG. 19
F
522
CLOCK CHECK?
F
ERROR RETURN
T
524
CHECK SUM?
F
ERROR RETURN
T
526
SAVE ONLY?
YES
B FIG. 19
NO
530
UNLIKELY DATE?
YES
532
CONFIRM?
YES
NO
NO
RETURN
534
APPEND REAL CLOCK TIME TO STRIPPED TEXT (REFERENCE DATA) AND WORKING DATA
536
COMPUTE DIGITAL SIGNATURE ON TIME STAMPED STRIPPED TEXT (REFERENCE DATA)
538
SET ARCHIVED FLAG IN WORKING DATA
540
UPDATE INDEXES, DATE OF LAST ARCHIVE
542
ENCRYPT BOTH WORKING DATA AND TIME STAMPED REFERENCE DATA
543
UPDATE CHECK SUM
544
STORE ENCRYPTED REFERENCE DATA IN WORM, STORE ENCRYPTED WORKING DATA IN READ/WRITE MEMORY
RETURN

FIG. 18

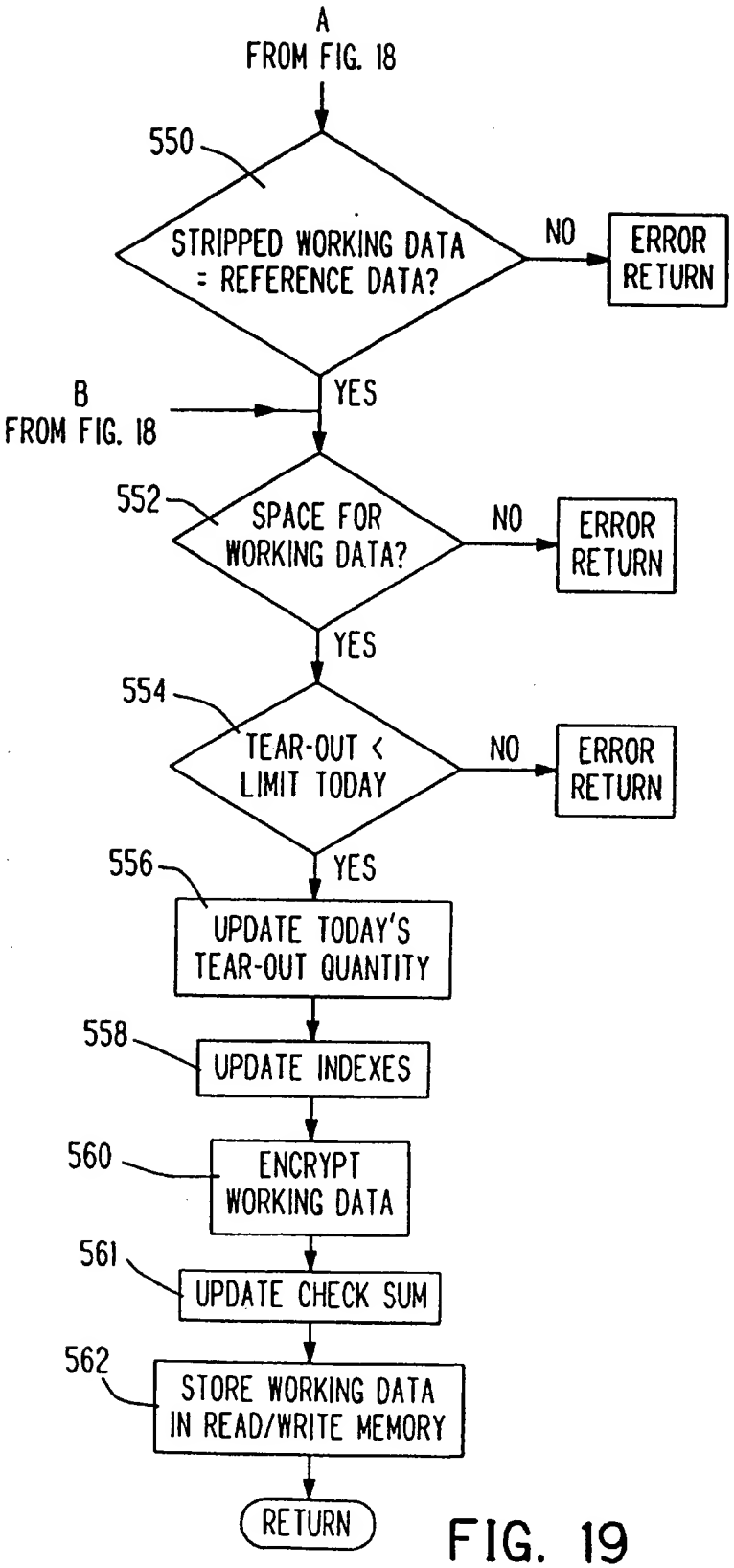

A
FROM FIG. 18
550
STRIPPED WORKING DATA = REFERENCE DATA?
NO
ERROR RETURN
YES
B
FROM FIG. 18
552
SPACE FOR WORKING DATA?
NO
ERROR RETURN
YES
554
TEAR-OUT < LIMIT TODAY
NO
ERROR RETURN
YES
556
UPDATE TODAY'S TEAR-OUT QUANTITY
558
UPDATE INDEXES
560
ENCRYPT WORKING DATA
561
UPDATE CHECK SUM
562
STORE WORKING DATA IN READ/WRITE MEMORY
RETURN

FIG. 19

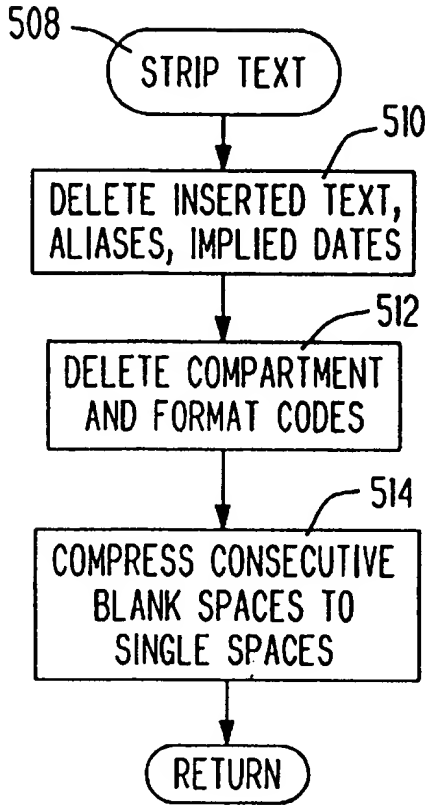

508
STRIP TEXT
510
DELETE INSERTED TEXT, ALIASES, IMPLIED DATES
512
DELETE COMPARTMENT AND FORMAT CODES
514
COMPRESS CONSECUTIVE BLANK SPACES TO SINGLE SPACES
RETURN

FIG. 20

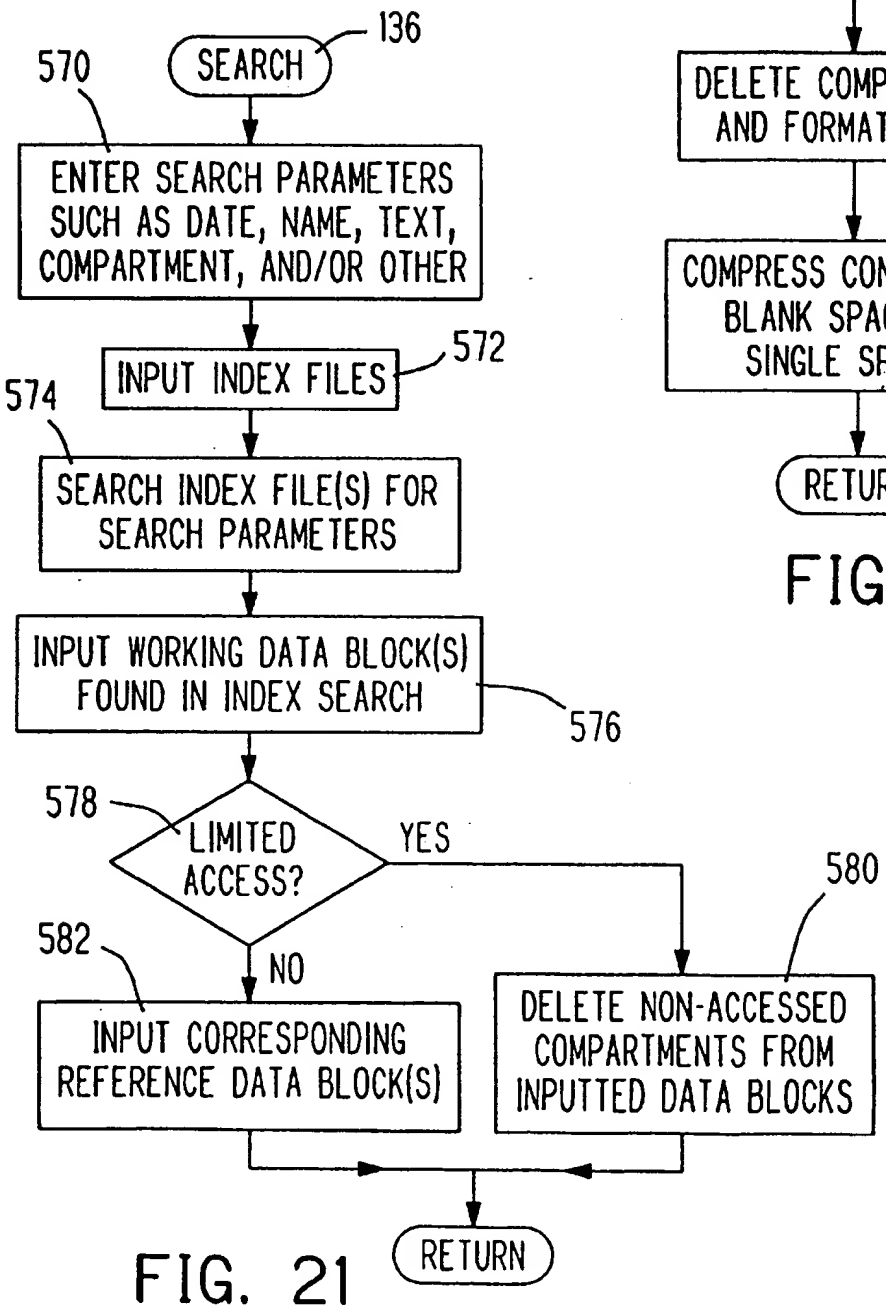

136
SEARCH
570
ENTER SEARCH PARAMETERS SUCH AS DATE, NAME, TEXT, COMPARTMENT, AND/OR OTHER
572
INPUT INDEX FILES
574
SEARCH INDEX FILE(S) FOR SEARCH PARAMETERS
INPUT WORKING DATA BLOCK(S) FOUND IN INDEX SEARCH
576
578
LIMITED ACCESS?
YES
580
DELETE NON-ACCESSED COMPARTMENTS FROM INPUTTED DATA BLOCKS
582
NO
INPUT CORRESPONDING REFERENCE DATA BLOCK(S)
RETURN

FIG. 21

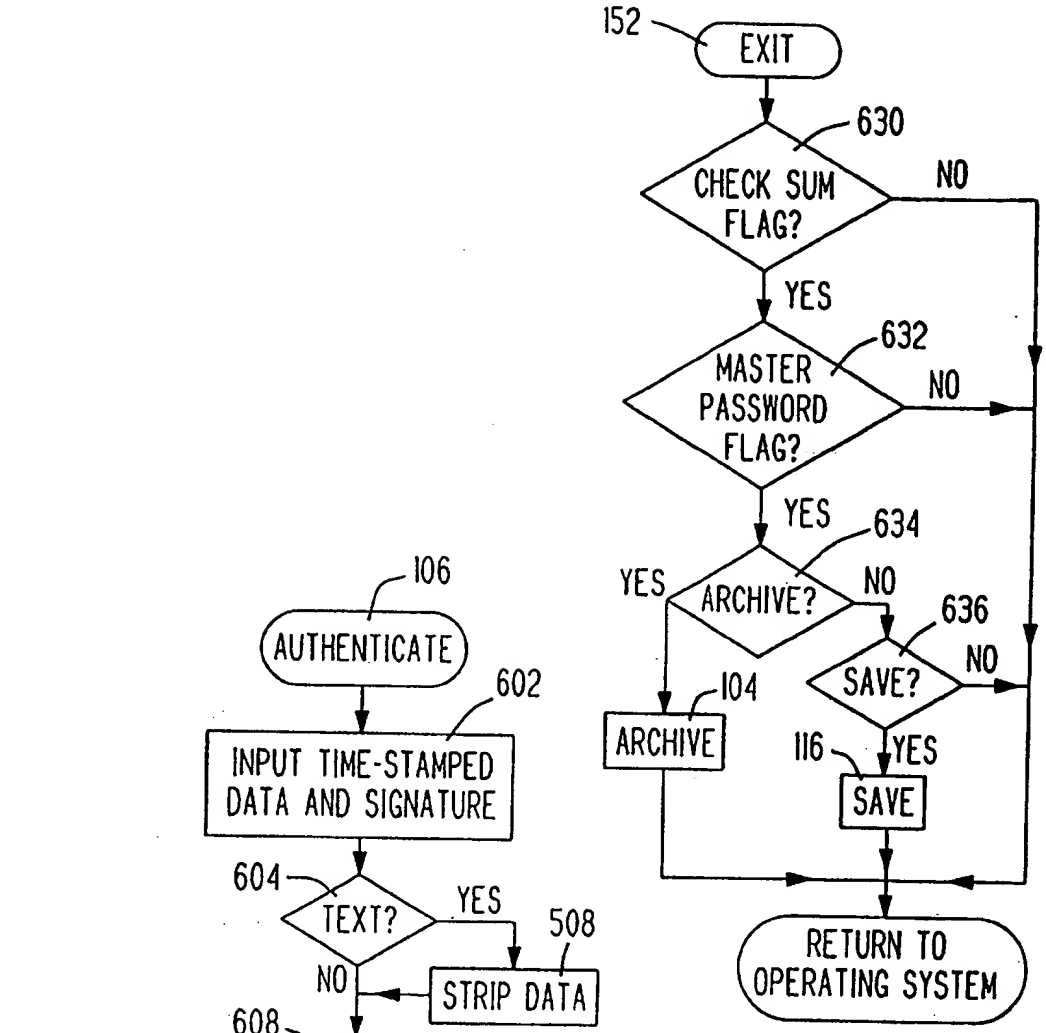

152
EXIT
630
CHECK SUM FLAG?
NO
YES
632
MASTER PASSWORD FLAG?
NO
YES
634
ARCHIVE?
YES
NO
636
SAVE?
NO
YES
104
ARCHIVE
116
SAVE
RETURN TO OPERATING SYSTEM
106
AUTHENTICATE
602
INPUT TIME-STAMPED DATA AND SIGNATURE
604
TEXT?
YES
508
STRIP DATA
NO
608
PUBLIC KEY TECHNIQUE?
YES
NO
610
AUTHENTICATE USING PUBLIC KEY
612
COMPUTE SIGNATURE
614
SIGNATURES IDENTICAL?
618
RETURN NON-CONFIRMATION SIGNAL
616
RETURN CONFIRMATION SIGNAL

FIG. 23

FIG. 22

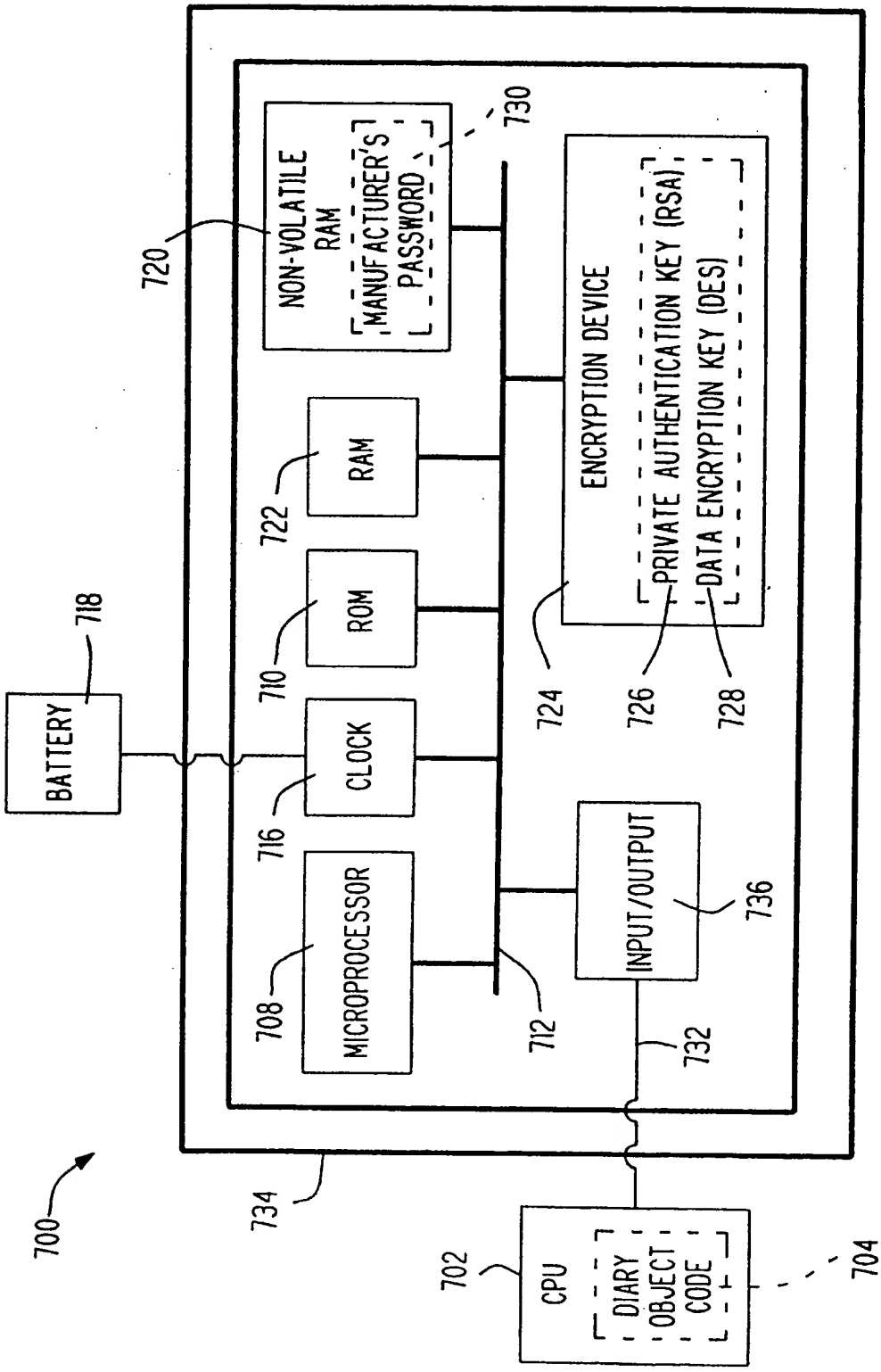

700
720
NON-VOLATILE RAM
MANUFACTURER'S PASSWORD
730
ENCRYPTION DEVICE
PRIVATE AUTHENTICATION KEY (RSA)
DATA ENCRYPTION KEY (DES)
RAM
722
ROM
710
CLOCK
716
MICROPROCESSOR
708
712
INPUT/OUTPUT
736
732
724
726
728
BATTERY
718
734
CPU
DIARY
OBJECT CODE
702
704

FIG. 24

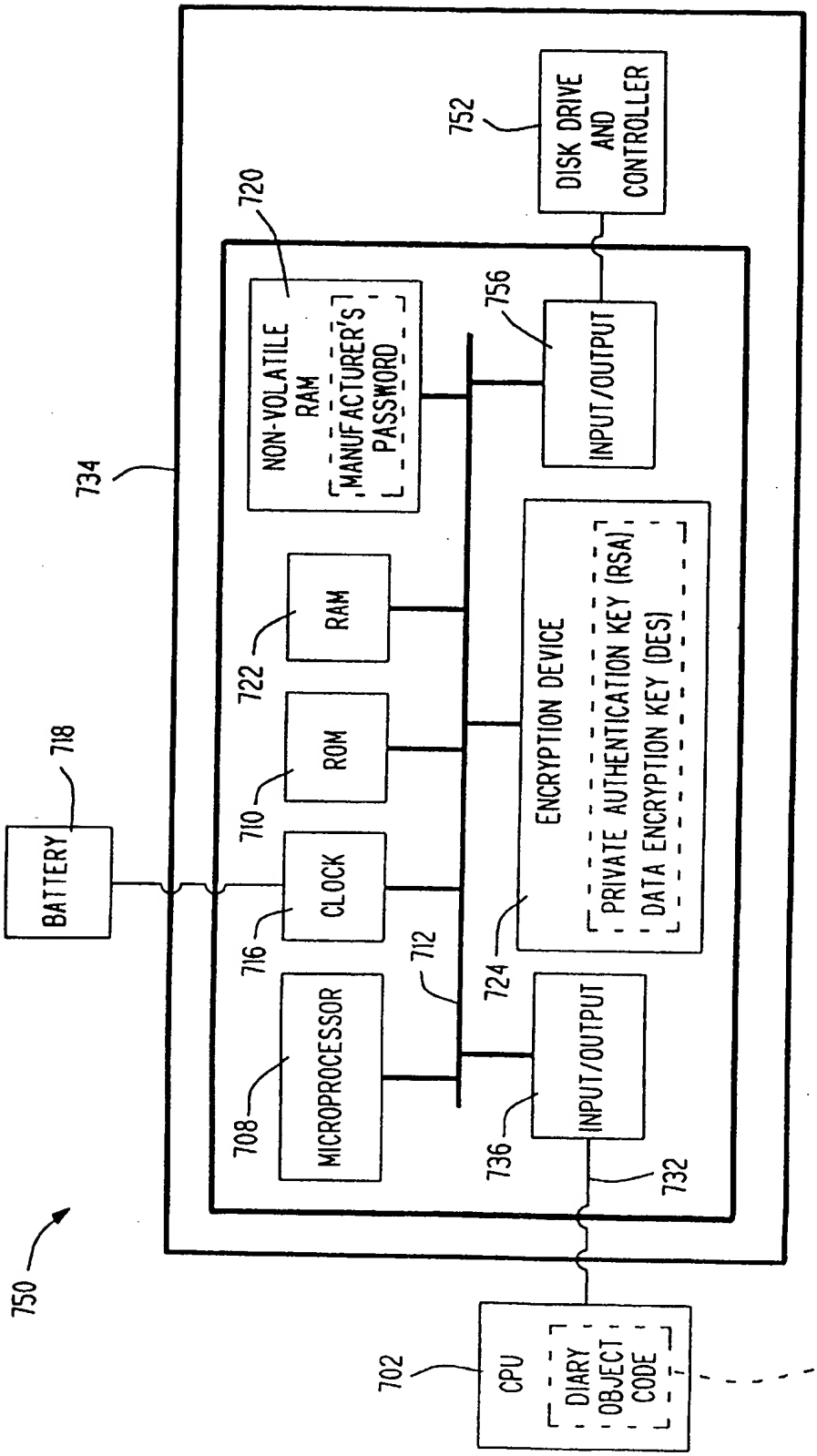

750
734
752
DISK DRIVE AND CONTROLLER
720
NON-VOLATILE RAM
MANUFACTURER'S PASSWORD
756
INPUT/OUTPUT
722
RAM
ROM
710
CLOCK
716
712
MICROPROCESSOR
708
ENCRYPTION DEVICE
PRIVATE AUTHENTICATION KEY (RSA)
DATA ENCRYPTION KEY (DES)
724
INPUT/OUTPUT
736
732
BATTERY
718
CPU
DIARY OBJECT CODE
702
704

FIG. 25

AUTHENTICATED TIME DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of Ser. No. 08/198,041, filed Feb. 17, 1994, which is a divisional application of Ser. No. 08/020,354, filed Feb. 22, 1993, for A PERSONAL COMPUTER DIARY, now U.S. Pat. No. 5,347,579 which is a continuation-in-part of copending U.S. patent application Ser. No. 07/637,675 filed Jan. 7, 1991, for DEVICES TO (1) SUPPLY AUTHENTICATED TIME AND (2) TIME STAMP AND AUTHENTICATE DIGITAL DOCUMENTS now U.S. Pat. No. 5,189,700 which in turn is a continuation-in-part of copending U.S. patent application Ser. No. 07/375,502 filed Jul. 5, 1989 for AN ARCHIVAL, SECURE DIGITAL MEMORY SYSTEM, now abandoned; these applications 07/637,675 and 07/375,502 are hereby incorporated herein in their entirety by reference.

TECHNICAL FIELD

The present invention relates to archived record keeping systems, such as a diary, for computers.

BACKGROUND ART

For hundreds of years artists, writers, politicians, and private persons have kept dairies. The diaries have generally been hand-written in a bound notebook on consecutive pages on which the date is either pre-recorded or is entered by the diarist as the entries are made.

This traditional method of keeping a diary has several useful features for the diarist and for subsequent readers. The diarist cannot easily go back and alter what he has written. Thus the diary is more likely a truer record of what the diarist actually thought at the time. The diary is "time stamped." The diarist may ink out or tear out pages, but it is clear to future readers that this has been done; the existence of an original record is apparent along with its mutilation to indicate the intent of the mutilator to destroy a particular entry.

Only a proportionally small amount of text can be inserted at a later date, and this can possibly be detected by changes in ink or slight changes in handwriting, or by the fact that the additions have been written in the margin. To the degree that these changes can be detected the diary is tamperproof.

Any reader of the diary can be sure by the handwriting of the identity of the person who wrote the diary; that is, the diary can be verified to be authentic. The diary may be locked away so that it is private.

Attempts have been made to provide a computer diary. Many such diaries are business oriented, designed to serve as reminders and not as permanent records.

The Tandy corporation has marketed a software product named "My Personal Diary" which allows the user to type into the dated image of a page of a diary. Although the software controls access to the diary pages by use of passwords, it is possible for anyone with access to use the software to turn to any date in this diary, past, present, or future, and to delete and enter data at will. This is very unlike a real personal diary in that there is no way to determine if an entry for any date was written at any time close to that date or was written or changed months or years later.

SUMMARY OF INVENTION

In a first aspect, the present invention is summarized in a computer system for archiving data blocks wherein a modifiable or working version of an original data block is stored along with a write-once read-many (WORM) record containing the original data, a stripped version of the original data, or a hash signature of the original data together with the present date. Modifications to the working data blocks are made so that the modifications can be identified and removed or restored to recreate the corresponding original data block. The authenticity of the original data with its original entry date can be readily determined along with the subsequent modifications to the original data block.

In a second aspect, the invention is summarized in a computer diary wherein storage of an original diary entry along with the present date is prohibited when the present date is before the date of the previously stored diary entry.

In a third aspect, the invention is summarized in a computer diary wherein the forming and editing of diary entries includes monitoring the input of diary entries to identify entry of selected text entries or aliases having corresponding lists of one or more previously stored specific identifying terms, displaying the one or more of stored terms corresponding to the entered selected text entry to enable the diarist to identify a correct term for the alias, and placing the identified term in the diary entry.

In a fourth aspect, the invention is summarized in a computer diary wherein the entry of diary entries for corresponding diary dates is monitored for the input relational date entries, and the diary includes formulas for computing absolute dates corresponding to the identified selected relational date entries so that the computed absolute dates can be placed in the diary entry.

It is an object of this invention to supply a computer diary system which will not only have the distinctive and useful features of a traditional diary, but also have many of the useful features which are attainable only through the aid of modern computers.

Another object of the invention is a diary which is to be kept generally proof against a casual attack by a typical user and can be implemented using software. Such a system need not necessarily be secure against a determined attack by a computer system professional or by a dedicated "diary tampering" program written by such a professional.

A further object of the invention is a computer diary with word processing, text time-stamping and authentication, secure archiving, and selective access to different portions, or "compartments", of the diary.

One feature of the present invention is the possibility for the diarist to designate segments of text with beginning and ending codes signifying different compartments of the text wherein a piece of text may belong to several different compartments, each compartment can have its own password, and examination of the diary can be selectively restricted to users with knowledge of the appropriate set of passwords for the compartments of interest to them.

Advantages of the invention include that the diarist can control access to the diary, that the diarist, even though he is the owner of the system, cannot alter, change the date of, or erase data which is time-stamped, authenticated, and already stored.

Another feature of the invention is the provision of the capability to "tear-out" a limited amount of data per day by putting text into a tear-out compartment with a password which cannot be extracted from the computer diary by anyone, including the diarist. The diarist may, however, choose to keep a record of the tear-out password outside the computer diary if he so desires.

In a further aspect of the invention the diarist can enter a limited amount of annotation data to previous dates, and if

desired by the diarist, such additions can be seen on display to be clearly distinct from data truly entered on that date by placing the annotation data in its own compartment with its own display defaults; the system ensures that the diarist is never able use the annotation capability to falsify the initial data to any person in possession of all the required passwords.

In a still further feature, the diary program ensures that data is never time-stamped with a date different from that of the current clock, nor with a time earlier than the most recent previous time a record was stored in the diary.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a general block diagram of major procedures included in one embodiment of a computer diary in accordance with the invention.

FIG. **2** is a flow diagram of initial procedures during startup of the computer diary of FIG. **1**.

FIG. **3** is a general diagram of object code used in the computer diary of FIG. **1**.

FIG. **4** is a general diagram of contents of a diary file produced and stored by the computer diary of FIG. **1**.

FIG; **5** is a flow diagram of a clock checking procedure used in the initial procedures of FIG. **2**.

FIG. **6** is a flow diagram of a setup procedure of the computer diary of FIG. **1**.

FIG. **7** is a view of a computer display screen produced in the setup procedure of FIG. **6**.

FIG. **8** is a view of a computer display screen produced in a main diary entry and editing procedure of FIG. **1**.

FIG. **9** is a table of built-in relative date phrases with corresponding reference dates and references to formulas for computing absolute dates from the relative date phrases for use in the procedure of FIG. **17**.

FIG. **10** is a table of user created relative date phrases with corresponding references to formulas for computing absolute dates from the relative date phrases similar to FIG. **9** but which can be created during the setup procedure of FIG. **6**.

FIG. **11** is a flow chart of one possible formula for computing absolute dates from relative date phrases referred to in the tables of FIGS. **9** and **10**.

FIG. **12** is a table of built-in generic terms or alias words used in the computer diary program of FIG. **1**.

FIG. **13** is a table of user generated generic terms or alias words used in the computer program of FIG. **1**.

FIG. **14** is an example of an unique alias identifier table containing lists of specific terms which can be selected to specifically identify aliases in the tables of FIGS. **12** and **13**.

FIG. **15** is a general block diagram of some diary entry and editing functions of the computer diary of FIG. **1**.

FIG. **16** is a flow diagram of computer procedures to control selection of appropriate permitted procedures in the diagram of FIG. **15**.

FIG. **17** is a flow diagram of relative date phrase monitoring and generic phrase monitoring procedures in the computer diary of FIG. **1**.

FIG. **18** is a flow diagram of a first portion of an archive/save procedure of the computer diary of FIG. **1**.

FIG. **19** is a flow diagram of a second portion of the archive/save procedure of the computer diary of FIG. **1**.

FIG. **20** is a flow diagram of a text stripping procedure used in the archive and restore procedure of FIG. **18**.

FIG. **21** is a flow diagram of a search procedure used in the computer diary of FIG. **1**.

FIG. **22** is a flow diagram of an authentication procedure used in the computer diary of FIG. **1**.

FIG. **23** is a flow diagram of an exit procedure used in the computer diary of FIG. **1**.

FIG. **24** is a block diagram of a computer system with hardware elements which can, alternatively, be used to perform some of the functions of the software embodiment of FIGS. **1–23** with greatly enhanced security.

FIG. **25** is a block diagram of a second computer system with hardware elements which can, alternatively, be used to perform some of the functions of the software embodiment of FIGS. **1–23** with still greater enhanced security.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. **1**, a computer diary in accordance with the invention includes a word processing core **102** along with an archive function **104** by means of which a user can time stamp and store a diary entry. The word processing function **102** can only edit or modify an archived diary entry by marking archived diary text or by inserting marked text or other data so that the original archived diary entry can be reconstructed. Authentication by function **106** is by comparing the reconstructed text with a write-once read-many (WORM) version of the original diary entry or by comparing an encrypted hash signature of the reconstructed text and original date with a WORM hash signature of the original time stamped entry. Preferably the program includes encryption **110** and decryption **112** with storage input/output **114** (for example magnetic disk input/output) of diary entries and various file parameters. The user can save an incomplete diary entry with save function **116**, without time stamping and archiving, for later recall and completion, but such incomplete diary entry is not accorded a time stamp.

The diary program begins with the initialization module **120** after which the user selects a file in function **122**. The first time user of the diary selects a new file name which results in the program at **124** branching to a file setup function at **126**. In file setup **126**, the user enters several optional file parameters including a master password. The user can also designate user compartments or text markers with associated passwords for permitting others limited access to the diary file.

When a stored file is selected, the program branches at **124** to a function **130** where several file parameters previously created in setup **126**, including the master password and any user compartment passwords are input from the file via the input/output **114**. If the user correctly enters a master password at **130**, then the program proceeds to the word processing and user interface **102** with full read/write access to diary entries in the file granted at **132**. The master function **132** determines the existence of any previously saved but non-archived diary entry and inputs any such entry for display by the word processor user interface **102**. In the absence of an uncompleted diary entry, the user interface is set for the user to enter a new diary entry.

If the user fails to enter the master password at **130**, the user is queried to enter any user compartment passwords. Correct entry of one or more user compartment passwords results in the granting of limited read-only access at **134**. The limited user is only permitted to input via storage input/output **114** those compartments (text previously marked by the master diarist) associated with correctly entered passwords. Also the limited user is permitted to search and retrieve **136**, print **138**, and to import and export **140** from and to an external text or data file. Other diary and word

processing functions such as archive **104**, storage output through input/output **114**, save **116**, setup **126**, and other text editing and modification functions are not permitted to the limited user.

Failure to enter any correct password in procedure **142** results in access denied **142** and return to master password query.

The program includes monitoring procedures **144** and **146** for relative date phrases such as today, tomorrow, yesterday, last Sunday, etc., and for alias words such as pronouns like he, she, we, they, or user identified non-specific names or aliases such as first names like Bill, Susan, etc. When entry of a relative date phrase or an alias is detected, the program suggests insertion of a specific term, such as the precise date, or selection of a term from a table of terms such as full names of the possible aliases. Tables of relative date phrases, alias words, date formulas and specific terms, can be edited and created in procedures **148** and **150**. Alternatively, the diarist can elect not to insert the absolute date or the specific term.

A user with master access options after electing exit function **152** is offered options to archive or save a diary entry if it was not previously archived or saved.

In the initialize procedure **120** as illustrated in more detail in FIG. **2**, the program is first loaded in step **160** and then sensitive program elements in the program are decrypted in step **162**. FIG. **3** shows the structure of the object code in which, immediately after control is passed to the loaded program at **164**, control proceeds to decryption code **166** which decrypts sensitive data **168** which for example includes a secret, private (RSA) key, a data encryption (DES) key, and a manufacturer's password and places the decrypted data in operating condition with the rest of the object code. The elements **168** are encrypted with a conventional data encryption standard (DES) by the program manufacturer who includes the decryption code with its key in the program code **166**. The purpose of the encryption of program elements **168** is to make it more difficult for someone to falsify authentication or to alter the archive file by decrypting, altering, and re-encrypting with another program. The program then jumps at **170** to the main part **172** of the program where in step **122**, FIGS. **1** and **2**, a file is selected.

The file structure, shown in FIG. **4**, includes a check sum **196** which can be produced by conventional summing, cyclic redundancy check, cryptographic secure hash procedures or the like; a check sum flag **198**; a clock flag **200**; the date **204** of the most recent archive; the quantity **206** of today's tear-out data together with today's date **208**; the tear-out password **210**; tear-out compartment display data **212** such as whether an tear-out indicator with the number of words in the tear-out section or compartment is displayed; the master password **214**; user compartment names, passwords, and display data **216**; set or default parameters **218** which determine the display of built-in compartments or marked text such as cross-outs, inserts, implied dates, implied alias, etc.; user alias tables **220**; user date tables **222**; diary entry sections **224** for each archived diary entry including reference or WORM data **226** and working or read/write data **228** with archive flag **229**; an index file **230** of all the working data including all text words (except for defined trash words like "a", "the", "and", "or", etc.), implied dates, implied alias terms, and compartment or text marking codes; and an index file **232** of the diary entry sections **224** with their archive date of entry.

Referring back to FIG. **2**, the program in step **240** recalculates the checksum of the file and compares this checksum number with the checksum number **196** stored in the file. If these checksum numbers are equal, the program branches to step **242** where a checksum flag is set true (T); otherwise the checksum flag is set false (F) in step **244** indicating that the stored file has been corrupted by use of some other program. A warning is issued if the checksum flag is F because the diary program will not permit further archiving to this archive file. In this case the diarist may choose to access a backup copy of the archive file in hopes that it will pass the checksum test.

The user is requested in step **248** to enter a master password which is compared to the master password **214** read from the file of FIG. **4**. If they do not match, then the user is given the opportunity to enter a manufacturer's password in step **250**. The manufacturer's password is revealed to the user when the user calls the manufacturer and is properly identified (for example, by giving the maiden name of the user's mother as written by the program purchaser on the user licensee registration card). Thus should the registered user forget the master password, full access can be obtained by calling the manufacturer. Master access is granted in step **252** when either step **248** or **250** are true.

The diarist may grant limited access to selected data or marked text in the file by giving a limited viewer the compartment password of the corresponding data or marked text. When the limited viewer fails to enter either the master or the manufacturer's password, the limited viewer can enter a compartment password or passwords in step **254**. If the entered password or- passwords match one or more compartment passwords recorded in section **216** of the file, then in step **256**, limited access is granted by setting the master password flag to F and a compartment read flag or flags to T for all compartments having the correctly entered password or passwords. Failure to enter any correct password results in the step **254** being false and returning to step **248**.

When either full or limited access has been granted by either step **252** or step **256**, the program performs the clock check routine **258** which, as shown in FIG. **5**, first checks the clock circuit for failures in step **270**. If a conventional computer clock circuit is used, loss of battery power or other clock malfunction will normally indicate a failure, and if a secure clock is employed, such clock will normally include one or more checking functions to insure that the clock is operating properly and has not been tampered. If the clock diagnostic check test in step **270** is true, then the clock time is compared in step **272** with the last archive time **204** recorded in the file of FIG. **4**. This step checks for changing of the clock time; for example the clock circuit on most computers can be set to any previous time by the computer setup procedure to attempt to falsify the date of a diary entry. When the clock time is greater than the recorded last archive time then the clock flag is set to T in step **274**. If either step **270** or step **272** are false then the clock flag is set to F in step **276**. Referring back to the procedure of FIG. **2**, the setting of the clock flag to F in procedure **258** results in the program branching at step **280** to step **282** where the user is warned that no further archiving to the file is permitted because of the clock failure or incorrect date.

In step **284**, the program reads the set or default parameters **218** for the file of FIG. **4** and sets the computer display in accordance with the read parameters. The program then proceeds to the user interface of the word processing program **102**.

The setup procedure **126** which is called when a new file is selected during program startup or can be called from the

user interface is shown in FIG. 6. In step **290**, the user is given the opportunity to set various system and compartment parameters. As illustrated in the display screen shown in FIG. 7 and used for setting the parameters, there are a variety of "compartments" listed in the second column **292** including "CROSS-OUT", "INSERTION", "INSERTION_DATE", "ALIAS", "IMPLIED DATE", "TEAR-OUT", "DEFAULT", "PATENT", "FINANCES", "MOTHER", "LINDA", and "THE_KIDS". The listed "MASTER" and "MANUFACTURER" are not compartments but are included because of their password functions. The first nine listed compartments including "CROSS-OUT", "INSERTION", "INSERTION_DATE", "ALIAS", "IMPLIED DATE", "TEAR-OUT", and "DEFAULT" are system compartments while the last five listed compartments "PATENT", "FINANCES", "MOTHER", "LINDA", and "THE_KIDS" are examples of user created compartments. User compartment names can be changed, added, and deleted in the setup procedure, but modification of the listed system compartment names is not permitted.

In the third column **294**, passwords for the various compartments are listed, except that the manufacturer's password is never available to the user in setup and the tear-out password is only available during the setup of a new file or until changed from a default (a default tear-out password such as "PASS" is recognized by the software for being displayed and changed but any other tear-out password can not be displayed or changed). During the setup of a new file the entry of a "MASTER" password is required. The manufacturer's password can be invalidated by depressing the "alt" and the "i" keys simultaneously while the cursor rests in the manufacturer's password row and column in FIG. 7. This causes the manufacturer's password to be replaced by the DES encryption of a user-input value using the secret DES key, and the entry in the password column for MANUFACTURER to change from "valid" to "not valid." The program provides no capability to replace the new entry in the manufacturer's password location with another value, nor to change the flag from "not valid" to "valid." These procedures make it impossible for the diarist or the manufacturer to know the new value in the manufacturer's password location by themselves; although it is still possible that in collaboration they could do so if the diarist retains a record of his input. The passwords for the other listed system compartments "CROSS-OUT", "INSERTION", "INSERTION_DATE", "ALIAS", "IMPLIED DATE", and "DEFAULT" can be changed from default words while entry of passwords for user created compartments "PATENT", "FINANCES", "MOTHER", "LINDA", and "THE_KIDS" are required when the user creates the compartment.

In the first column **296** are listed the compartment boundary codes by which the text segments or compartments are marked. The program employs the ASCII coding scheme for eight-bit bytes ranging from decimal 32 to decimal 127, and the boundary codes are selected from the remaining codes from decimal 0 to 31 and from decimal 128 to 255. Codes within these latter two ranges and which are not reserved for compartment boundary markers can be used for print or display formatting or for displaying various foreign and other characters and symbols in accordance with one or more of the conventional symbol sets employed in computers and printers. The boundary codes for the system compartments are fixed by the program and the program assigns boundary codes to user compartments as they are created. In the display, the boundary codes are displayed as reverse image characters, or characters with selected background and foreground colors. The boundary codes are placed at the beginning and end of a text segment to mark that text segment as comprising a compartment; for example in FIG. **8** the boundary code for the default compartment "¦0¦" is placed at the beginning of the text before "Last" and after "church." to define a segment of the text from "Last" through "church." as belonging to the "DEFAULT" compartment. It is noted that compartments can be nested, that is, a compartment can defined for all or a portion of the text contained within another compartment.

Referring back to FIG. 7, the fourth column **298** is set by the user to indicate whether the compartment is to be displayed except that the tear-out compartment is normally not available for being displayed as indicated by the word "none". The tear-out compartment can only be displayed under limited access granted by steps **254** and **256** of FIG. **2** after entry of the correct password for the tear-out compartment. When the text display for a defined compartment is set to "ON" in column **298**, then the text within that compartment is displayed in the word processing screen of FIG. **8** with the corresponding compartment boundary codes, and when set to "OFF", then neither the text nor boundary markers are displayed in the word processing screen even if the required passwords have been entered.

The diarist can select the color of the text displayed within in a compartment, where a color computer monitor is employed, as shown in column **300** of FIG. 7. Priority of the compartments is set by the diarist in column **302**. The color actually used, if text is in more than one compartment, is in accordance with the compartment with the highest priority, given in column six **302**. If the two nested compartments have equal priorities, the color of the compartment closest to the top of the list is used. However, the tear-out compartment always has the highest. The compartments above the tear-out compartment in FIG. 7 have neither independent color nor priority, as indicated by the dashes, since they are always within another compartment, and thus are given the same color and priority as the compartment of the text within which they are placed.

The last column **304** in FIG. 7 enables the user to set a missing text indicator in the event that the text display for that compartment is "OFF". For example, the missing text indicator for the TEAR-OUT compartment is "ON" in FIG. **7** and in FIG. **8**, text in the tear-out compartment is indicated at **310** by "¦T73¦". The indicator "T" is the boundary code indicator, see column **296** in FIG. 7, for the tear-out compartment, and the number **73** indicates that 73 words are in the tear-out compartment. Only for text missing because it has been torn out is the amount of text (73 words in this case) indicated. A missing text indicator **312** shows that patent compartment (code ¦1¦) contents are missing. However, there is no indication of how much text is missing.

After the compartment parameters have been set and saved by the step **290** in the setup procedure of FIG. **6**, the program proceeds to the edit/create date and alias table functions in step **320**. A built-in date word phrase table **322** is shown in FIG. 9; this table is built into the object code and can not be edited by the user. The built-in date phrase table **322** contains common relative date terms illustrated in column **324** such as "yesterday", "last night", "tomorrow", "today", "this morning", "Thanksgiving", "Christmas", etc. together with a possible reference date in column **326** and a formula index number in column **328**. The formula pointed to by each formula index number **328** calculates an absolute date, for example "25 DEC 1992", for the corresponding relative date phrase **324** "last Christmas" using the present clock date and the reference date **326** when required. For example the formula for "last Christmas" as shown in FIG.

11 first determines in step 332 if the present month and day-of-month is greater than the reference date for the current year, and if so, combines the present year with the reference date in step 334, otherwise the previous year is combined with the reference date in step 336. Formulas for other relative date phrases can be easily composed by a skilled programmer.

A user's date word phrase table 222, stored in the file of FIG. 4, is shown in FIG. 10 and contains date phrases, reference dates and formula numbers entered by the user in step 320 of FIG. 6. Typically this user's date phrase table contains birthdays and anniversaries of the diarist, relatives and friends and other important dates. The user's date phrase table of FIG. 10 is used in the same manner as the built-in date phrase table of FIG. 9.

A built-in alias word table 340 is shown in FIG. 12, a user alias word table 342 is shown in FIG. 13 and a unique alias identifier table 344 is shown in FIG. 14. The alias table 340 is built into the object code while the tables 342 and 344 are created or modified by the user in step 320 of FIG. 6 and stored in the user alias table section 220 of the file of FIG. 4. The built-in alias word table 340 contains a list of commonly used pronouns, such as "he", "she", "it", etc. and other common terms such as "mother", "home", etc. The user table 342 of alias words typically contains first names of relatives and friends of the diarist. The unique alias identifier table 344 contains each of the alias words of tables 340 and 342 together with respective lists of specific names or terms identified by each of the alias words.

In the bottom line of the screen 290 are listed toggles 314, 315 and 316 which can be pointed to and used to quickly change the display screen if the master password is T. For example, pointing and clicking on text display toggle 314 alternates the display of compartments between all displayed and the settings of column 298. The missing text toggle cycles through all on, all off and the settings of column 304. Similarly the colors toggle 316 cycles through all on, all off and the settings of column 300.

After modification or creation of the tables of FIGS. 10, 13 and 14 in step 320 of FIG. 6, the program proceeds to step 348 where other parameters of the program are edited. For example, the user can identify a particular display card such as Hercules, VGA, etc. and can identify a particular printer to be used by the program.

The word processor 102 of FIG. 1 includes a number of functions as illustrated in table 360 of FIG. 15 which can be called by the pointing and clicking by means of a mouse on one of the user interface buttons shown in FIG. 8, pressing a cursor movement key, pressing a selected function key, or simultaneously pressing a ctrl or alt key with a selected function key. The functions listed in table 360 are divided into columns under limited access functions 362 and master access functions 362, and the master access functions are further divided into columns under non-archived text 366 and archived text 368. As shown in FIG. 16, the calling of a word processing function proceeds to step 372 where it is determined if the master password flag, set in step 252 or 256 of FIG. 2, is true. If false, the program in step 374 determines if the called function is one of the functions permitted under in the limited access column 362 of FIG. 15, and if so proceeds to perform that limited access function in step 376; if the called function is not permitted under limited access the program ignores the function call and returns to the user interface.

When step 372 of FIG. 16 is true, the program goes to in step 378 where it is determined whether the current text of interest has been previously archived. All text in a diary entry which has not been previously archived is non-archived text. Text previously inserted (placed in an insertion compartment) in a previously archived diary entry is also non-archived text; only the original archived text is designated as archived text. If step 378 is true, the program branches to step 380 to perform the corresponding archived function in column 368 of FIG. 15; otherwise the program branches to step 382 to perform the corresponding non-archived function in column 366 of FIG. 15.

The word processing functions illustrated in FIG. 15 include, beginning at the top row of the table, text display 384, cursor movement 386, text entry 386, file import 390, scrolling text 392, deletion 394, printing 396, blocking text functions 398, and exporting to file 400. It is noted that the listed word processing functions are only exemplary, and that many other word processing functions could be included and/or one or more of the listed functions could be excluded without affecting the useability of the diary program.

Text display under limited access is limited to those compartments for which the user has entered a correct password. Preferably, when one or more diary entries 224, FIG. 4, are read from the storage file under limited access and placed in a working memory buffer, the program deletes from the buffer all text and data that is not contained in a compartment to which access is granted. Additionally each diary entry 224 includes both reference data 226 and working data 228; the reference data is not used in any limited access function and can be deleted from the buffer or not inputted from the storage file when only limited access has been granted. When master access has been granted, working data or text 228 is displayed according to the display parameters set in the setup function of FIG. 7; the reference data 226 is never displayed except insofar as the working data includes reference data or text within displayed compartments.

The cursor movement functions 386 and the scrolling text functions 392 are generally the same for all displayed text. Cursor movement and scrolling under either limited access or master access is only performed in displayed text or data. Printing and exporting functions 396 and 400 differ between limited access and master access in that under limited access only that text in compartments for which access has been granted can be printed or exported whereas under master access text in any displayed compartment can be printed or exported. Printing and exporting of blocked text in function 398 is similarly limited to displayed text or data.

Any function which involves modification of the working data, such as text entry 388, import 390, deletion 394, and some block functions 398 like block deletion, copying, moving or text marking is not permitted under limited access.

Data modification functions differ between archived text and non-archived text. When a diary entry is archived, the corresponding reference data 226, FIG. 4, is produced and stored, and this reference data cannot be modified or changed by the diary program; editing reference data or any other data by a conventional file editing program will most likely render the file or diary entry invalid and unusable in the present diary program. However, working data 228 can be modified or changed in the computer diary program with the provision that if the corresponding diary entry has been previously archived, the modifications and changes are made in a manner that the original archived text or data can be recreated from the working data. Thus under the archived

text column **368**, text entries **388** and file imports **390** are placed in insertion compartments (see the text segments bracketed by ¦I¦ . . . ¦I¦ in FIG. **8**). Under the non-archived text column **366**, text entries or imported files are not marked in insertion segments or compartments. Deletions **394** under column **368** of original archived text are made by placing the deleted text in a cross-out compartment (see text segments bracketed by ¦X¦ . . . ¦X¦ in FIG. **8**) while deletions to non-archived text are made in the usual manner of deleting such text from the working word processor buffer. Any insertions into insertion compartments that have been made in previously archived original text are recognized as non-archived text, and further insertions and deletions in such insertion compartment text are made under column **366** in spite of the fact that the diary entry has been previously archived.

In text blocking **398** under the archived text column **368**, deletion of blocked text involves marking the text block in a cross-out compartment. Copying of blocked archived text involves placing the text in an insertion compartment at the new copy location. Moving of blocked archived text includes both marking the blocked text in a cross-out compartment at the old location and marking the blocked text in an insertion compartment in the new location. Where copying or moving involves archived text at one location and non-archived text at the other location, such copying or moving would be include operation under archived column **368** at the one location and operation under non-archived column **366** at the second location.

Blocking functions **398** under archived text column include the option of marking the blocked text in a tear-out compartment (see the tear-out marker ¦T73¦ in FIG. **8**). Text segments placed in a tear-out compartment are not available for display or printing unless the user remembers the tear-out password or has kept a copy of the tear-out password and in starting the diary program elects not to enter any master or manufacturer password but correctly enters the tear-out password at step **254** in FIG. **2**. In this manner the tear-out compartment resembles in result a diarist tearing out a page or a portion of a page of a diary; the tear-out and its relative quantity can be made visible but the contents of the tear-out are normally not available.

Text blocking **398** is also used to mark a blocked text segment in one or more of the user defined compartments listed below the default compartment of FIG. **7**. Although not illustrated in the drawings, the word processor includes such standard options as blocking and marking text for underlining, italics, etc. A block of text is highlighted with the mouse or cursor and then a button is selected resulting in underline, italics, etc. codes being placed before and after the block of text. The display or printing portion of the word-processing program detects these codes and displays the text as underlined, italics, etc. usually with the codes hidden. An option usually exists to either hide or reveal the codes for the bold face, italic, etc. options. Also standard delete options exist to delete normal printing and formatting codes as well as compartment codes other than the tear-out compartment codes as desired. System compartment codes in non-archived text can also be deleted.

Text or data entry is always into one or more (if nested) of the default and user defined compartments. For example in FIG. **8**, the upper seven lines of displayed text are in a default compartment bracketed by ¦0¦ . . . ¦0¦. The patent data in line **8** is not in the default compartment but is within its own compartment ¦1¦ . . . ¦1¦. Line **8** is in a default compartment. The compartment in which data or text is to be entered is selected by pointing and clicking on the compartment button at the top of the screen in FIG. **8** or by pressing an appropriately assigned function key or simultaneous combination of shift, CTRL or ALT and function key. Any text not otherwise placed in a user defined compartment is placed by the program in the default compartment.

During text entry or cursor movement, the word processor in functions **144** and **146** of FIG. **1** monitors words at and near the cursor and suggests absolute dates for relative date phrases and correct unique identifiers for aliases. A procedure called by text entry or cursor movement for performing these functions is illustrated in FIG. **17**. In step **410** the program determines if a date phrase (phrase matching any of the date phrases listed in the first columns of the tables of FIGS. **9** and **10**) is near the cursor. If true, then in step **412** it is determined if this date phrase has been previously detected such as by being highlighted. If not, then in step **414** the newly detected date phrase is highlighted (see highlighted text **430** in FIG. **8**) and any previously highlighted date phrase is returned to normal. Also in step **414**, the absolute date for the date phrase is computed using the formula pointed to by the corresponding formula index number of FIG. **9** or **10** if there is no implied date compartment ¦ID¦ . . . ¦ID¦ immediately following the phrase. The calculated absolute date or an already existing implied absolute date is displayed at **418** in the user interface of FIG. **8**, and the user is given the opportunity in step **422** of confirming, step **424**, or declining the suggested or existing implied date or of entering manually another absolute implied date, step **426**; as a program setup option the absolute date may or may not be confirmed by default if the user continues to enter text or move the cursor. In either of steps **424** or **426**, the corresponding implied absolute date is placed in an implied date compartment immediately after the date phrase. An implied date indicator ¦ID¦ is not displayed after the relative date phrase unless the corresponding missing text indicator in column **304** of FIG. **7** is ON and the implied date itself is not displayed unless the corresponding text display indicator in column **298** is ON.

From steps **424** and **426**, from step **422** when decline is chosen, from step **412** if true or from step **410** if false, the program proceeds to step **436** where the words near the cursor are compared to the alias words in the tables of FIGS. **12** and **13**. If there is a match then in step **438** it is determined if the alias word has been previously detected such as by being already highlighted. When step **438** is false, the program in step **440** highlights the newly detected alias word, removes the highlighting from the previous alias word if displayed, and displays the corresponding list of specific alias identifier words from the table of FIG. **14** at **442** in FIG. **8** if the alias word does not have any alias compartment marker ¦A¦ immediately following the alias word; if the alias word is followed by ¦A¦ the contents of the alias compartment are displayed at **442**. The diarist in step **444** is given the opportunity to select one of the displayed specific identifier terms by simultaneously pressing ALT and the number of the identifier term (the identifier terms can be scrolled if they can not all be displayed in the space **442**) causing the program in step **446** to insert the selection into an alias compartment immediately following the alias word. When an alias compartment already exists at step **444**, the diarist can simultaneously press ALT and "I" to erase the existing the existing identifier term and call the corresponding list for display at **442** and selection. Simultaneously pressing ALT and "A" at step **444** causes the program to branch to step **448** where the diarist can enter a new specific identifier term into the corresponding list in the alias table and into an alias compartment immediately following the alias word. Press-

ing ALT and "D" simultaneously results in no alias identifier term being selected. If the diarist continues to type or move the cursor, the program in accordance with a setup default option either inserts no alias compartment or selects the first displayed specific identifier term in step **446**, or makes no change if the alias compartment already exists. When a new term is added in step **448**, or a selection other than the first selection is selected in step **446**, the program in step **450** sorts the corresponding list in the alias table by placing the current selection as the first item in the list, and the next closest preceding different alias identifier term (found in the corresponding list) as the second term in the list. The third location in the sorted list, if different from the first two, is the unique identifier most frequently found in the preceding two pages of diary entries. The order of any remaining terms following the second term remains unchanged.

The archive/save functions **104** and **116**, FIG. **1**, are illustrated in the procedure of FIGS. **18** and **19**. The save function **116** allows the diarist to temporarily save a new diary entry that is incomplete without archiving. When a non-archived diary entry is saved (as contrasted with archived) the diary program stores a corresponding working data section **228** without forming and storing any reference data section **226**, and the corresponding archive flag in the working data will be false. When the diary entry has previously been archived, the save and archive functions are the same. In step **502** it is determined if the master password flag is true; no save or archiving is permitted for a user with limited access. The existence of suitable data is determined in step **504**; the saving or archiving of an empty diary entry or one without any words or displayable data is generally prohibited.

Next in step **506** the program determines if the data is to be stripped. Generally all diary entries are to be stripped; however if a diary entry consists entirely of graphical data then stripping could distort the data to the extent that no useable data remains after stripping. The stripping procedure **508** is illustrated in FIG. **20** and includes step **510** where any text within insertion, insertion date, alias, and implied date compartments is deleted, step **512** where compartment and formatting codes are deleted, and step **514** where consecutive blank spaces are compressed to single blank spaces. This results in a canonical form of the text. A person skilled in the arts of compression and encryption will appreciate that many other canonical forms are possible.

Referring back to FIG. **18** in step **520**, it is determined if there is an archive flag for the present diary entry, i.e. if the present diary entry has been previously archived. A diary entry can only be archived once, i.e. stored reference data **226** is WORM data and cannot be changed; changes can only be made to the working data **228**. When the diary entry has not been previously archived, the program proceeds to steps **522** and **524** where the clock and check sum flags, respectively, are sensed to insure that the clock is appears to have the correct date and that the file has not previously been corrupted. In step **526** the program determines if the diarist wishes to only save the diary entry without archiving, i.e. did the user select save **116**, FIG. **1**. If false, the program then in step **530** determines if the present clock date is unlikely, for example more than one week past the last archive date. When true, the diarist must confirm in step **532** that the date is correct to ensure that the computer clock is not been set or is not malfunctioning to give a date in the distant future which would prevent storage of later diary entries with dates prior to that future date.

In archiving the diary entry, the program at step **534** appends the real clock time to the stripped text and working data. Then in step **536** a digital signature is computed on the time stamped stripped text; the digital signature is a one-way encryption of the text and time data into a fixed length code that is most highly unlikely to be reproduced if changes were made in the text or data. This digital signature is appended to the time stamped stripped text to form the reference data **226** of the corresponding diary entry. Next in step **538** the archive flag in the working data is set true following which the indexes **230** and **232** and the date **204** of the most recent archive are updated in step **540**. The reference data **226** and working data **228** are then encrypted in step **542**, the checksum **196** is updated in step **543**, and the encrypted reference data working data are stored in step **544**.

If in step **520** of FIG. **18**, it is found that the diary entry has previously been archived, i.e. the archive flag is true, then the program branches to step **550** of FIG. **19** where the stripped working data is compared to the stored reference data. Alternatively where the reference data is only a digital signature, the step **550**, FIG. **19**, computes the digital signature on the stripped working data with appended time stamp (see step **536** of FIG. **18**) and compares the resulting digital signature with the stored reference data. Step **550** detects modification of the original diary entry portion of the text by any program other than the present diary program and when such a discrepancy is uncovered produces an error message and prevents storing the modified working data.

If there is a match in step **550**, then the program proceeds to step **552** where it is determined if there is sufficient disk storage space to save the file with the modified or new working data. Step **552** is also the entry point for a branch from step **526** when the diarist has selected to save an new diary entry without archiving. In the next step **554** the program determines if the quantity of tear-out words for today exceed a maximum limit. The diarist is inhibited from making large scale tear-outs of major portions of the stored diary entries by permitting the diarist to tear-out (place in the tear-out compartment) only a relatively small portion of any large quantity of diary text; the diarist over a period of several or many days may tear-out most or all of the text.

If the tear-out limit is not violated, then the program in step **556** updates the file tear-out quantity **206**, in step **558** updates the indexes **230** and **232**, in step **560** encrypts the working data, in step **561** updates the checksum **202**, and in step **562** stores the working data in read/write memory such as a magnetic disk.

The search and retrieve procedure **136** is shown in FIG. **21** and includes step **570** where the user enters one or more search parameters such as date, date range, name, key text words, compartment name, and the like. Next in steps **572** and **574**, the program inputs the indexes **230** and **232** and looks for the search parameter or parameters. When a match is found the corresponding working data block or blocks are input in step **576**. In step **578**, the program determines if there is only limited access, and if so, then deletes the non-accessed compartments from the inputted data blocks in step **580**; otherwise, the corresponding reference data block or blocks are input in step **582**.

The authenticate procedure is shown in detail in FIG. **22** wherein the first step is to input the time-stamped data (working data if reference data consists only of a signature) and the signature (reference data). If the input data is working data text, then the program branches at **604** to the strip data procedure **508**, FIG. **20**. At step **608** the program branches to conventional public key procedure **610** if the public key procedure is used in authentication. Otherwise, the program proceeds to step **612** where the signature is

computed from the stripped text and appended time stamp. This computed signature is compared to the signature in the archived reference data and if found identical at step **614** returns a confirmation signal in step **616**; otherwise a nonconfirmation signal is returned in step **618**.

As illustrated in FIG. **23**, the exit procedure **152**, FIG. **1**, begins with detecting the checksum flag in step **630** and the master password flag in step **632**. If either are false (F) then the program returns to the operating system. If both the checksum and master flags are true, then the program at step **634** gives the user the opportunity to call the archive function **104** so that any new diary entry that may have been produced can be archived. When the user declines to archive a diary entry at step **634**, the opportunity to call the save function **116** is presented in step **636**. In any event the program returns to the operating system at the end of the exit procedure.

In another embodiment of the digital diary, special hardware shown in FIG. **24** is used. An authentication/encryption device **700** is connected to the CPU **702** operating diary object code **704**, and may be used to improve the security of the time-stamping, authentication, and authentication verification as well as for the encryption and decryption of stored data. The device **700** comprises a microprocessor **708** to control the overall system under the control of a program stored in the Read Only Memory (ROM) **710**. Communication between the elements of the device is carried on via a bus **712**. Also included in the device is a digital clock **716**, powered by a trickle-charged battery **718** which can be accessed from outside the device in order to ensure un-interrupted power to the clock **716**. The clock **716** is set at the factory and is secured against being reset by anyone, including the owner of the device. The microprocessor **708** periodically runs diagnostic checks on the clock **716**, and shuts down all operations of the device should the diagnostics fail. One of these diagnostics is to periodically store the time in a non-volatile portion **720** of a random access memory (RAM), and to check that the current time is later than the stored time. The device also contains volatile RAM **722** used by the microprocessor **708** and an encryption device **724** to hold data during execution of processes directed by them.

The encryption device **724** is capable of computing digital signatures and of encrypting and decrypting data. It contains within it in a secure and tamperproof manner the RSA authentication private key **726** and/or the DES encryption key **728** which have been discussed previously. The manufacturer's password **730**, which has also been discussed previously, is stored in the embodiment of FIG. **24** in the non-volatile RAM **720** and thus is not encrypted and stored in the object code of the diary program as in the previous embodiment in FIG. **3** at **168**. Thus the diary program object code **704** does not contain any portion of object code to decrypt and replace those data in the object code (see **166** in FIG. **3**).

The option of invalidating the manufacturer's password in this embodiment is allowed to be a valid command to the encryption/decryption device **700** so long as the master password has been input to the device. The same procedure may be followed as in the software embodiment except that in this case the replacement of the original manufacturer's password takes place in the encryption device; the manufacturer's password and its replacement are placed in non-volatile RAM **720** in the encryption device.

The device **700** accepts data from the CPU **702** via a communications port **732** which passes through a physical seal **734** to an I/O port **736** connected to the bus **712**. The physical seal prevents access to the circuits and data in the device **700** except through the port **732**. The microprocessor **708** and the I/O port **736** prevent seizure of control of the data and the device through the port **732** on bootup. Once the device is booted the microprocessor treats all input as data and reissues only valid commands related to data authentication. A major function of the physical and electrical security is to ensure that the keys and manufacturer's password can be kept secret.

In a diary embodiment employing the authentication/encryption device **700**, the device **700** is used to time-stamp and authenticate data in place of using software algorithms as was accomplished in the previously described software only embodiment at step **536** in FIG. **18** or step **612** in FIG. **22**. The data is passed to the device **700** through the communications port **732** from the CPU **704**. The data is stored in the RAM **722**. The encryption device **724** is first used to compute the hash of the data. (This hash could alternatively be computed in the CPU and it alone be transmitted to the device **700** instead of transmitting the complete file and having the hash computed there.) Then the current time from the clock **716** is appended to the hash, and the encryption device is used to compute a digital signature of the hash and appended time using the authentication private key **726**. The hash, time, and digital signature are returned to the CPU **702**. At this point the diary object code flow resumes in FIGS. **18** or **22** as if steps **536** and **612** had proceeded strictly in the diary software object code.

A second use of the authentication/encryption device **700** is to encrypt and decrypt all data as it is stored and recovered from the archive file of FIG. **4**. In function **112** of FIG. **1**, the CPU **702** passes the encrypted file, or a portion thereof, to the device **700** with the appropriate decryption instruction to decrypt the data, and the decrypted data is returned to the CPU **702** by the device **700**. In function **110** of FIG. **1**, the data to be stored is passed to the device **700** by the CPU **702** with the appropriate encryption instruction and the encrypted data is returned to the CPU **702** by the device **700**. Instead of encryption and decryption being performed using the diary object code as in the previous embodiment, it is performed in the authentication/encryption device **700**.

When data is received by the device **700** to be encrypted it is passed first by the I/O port **736** to RAM **722** where it is encrypted by the encryption device **724** using the secret DES encryption key **728** and then the encrypted data is passed back to the CPU **702** by the input/output **736**. Decryption is performed in a similar manner.

The third and final function of the authentication/encryption device **700** is to perform authentication on data submitted to it. In this case the public key authentication step **610** of FIG. **22** which has been discussed above is performed within the device **700** instead of within the diary software. The authentication is performed using the public key of the private key-public key pair. The signature, decrypted using the public key, is returned to the CPU **702** where it may be compared to the stored time-stamped hash. The public key is stored within the encryption device **724** for convenience even though it is not secret and could be input with the data itself.

At this point we remark that there are methods of authentication which have only a single secret key, so called secret key methods. In this case the time-stamped text with the digital signature for which verification of the authentication is desired is input to the secret-key encryption/authentication device **700** and a new digital signature is computed on the

time stamped text without the current date being appended. Then the new digital signature is compared internally to the original digital signature and if they are the same a confirmation signal is emitted to the CPU. In this approach the newly computed signature cannot be returned to the CPU to check authentication by comparison with the existing signature since, if this were done the user of the device could falsify an authentication by submitting data with a realistic but falsified time-stamp and thus obtain the digital signature appropriate to any date without knowing the secret key. So in this case the device **700** follows the secret or non-public key path procedure outlined in FIG. **22**. The device **700** internally computes the digital signature (**612** of FIG. **22**) of the time-stamped hash and then internally compares (step **614** of FIG. **22**) to the input signature. If they are identical the device **700** returns a confirmation signal to the CPU **702**. If they are not identical a non-confirmation signal is returned but not the calculated signature itself. This same procedure would be followed if a secret key authentication method were used in the software only embodiment.

In a variation of the secret or non-public authentication approach a second nearly identical encryption/authentication device (not shown) with the same secret key but without the capability to output a signature could perform the same verification of authentication without the verifier being able to falsify the document after he has received it. Note that the second device need not have a real-time clock **716**, nor its battery **718**, nor need it have an encryption capability except as required to compute the digital signature. We may term these second devices secret verification devices. Obviously these devices will be substantially cheaper and more robust than the complete encryption/authentication devices. Distribution of as many copies as desired of these secret verification boxes to all those who need to verify authentication of messages authenticated by the first secret encryption/authentication device would provide many of the benefits of a public key authentication system. Of course the security of such a system rests on the ability of the physical seal **735** and the electronic seals or safeguards to protect the private key **726** which, in the case of the use of a secret key would likely not be an RSA key. Such a second private verification device could also be routinely given to a third party to be used in case there were questions about the authenticity of some diary reference data which had been output. So long as the seals could be seen to be untampered with it would not be necessary to trust the third party.

The use of the hardware authentication/encryption device **700**, FIG. **24**, ensures that the time of a diary entry cannot be falsified either by resetting the system clock in the CPU **702**, nor by using advanced computer engineering methods to determine the secret keys and password **168**, FIG. **3**, in the object code and using them to access and/or change the passwords and data in the archive files.

There still remains the possibility that the complete archive files can be erased by use of another program. Someone with access to the encryption key, or to the encryption device **700**, but not the passwords could read the data even if they could not falsify it. These possibilities can be prevented by means of the secure archival data storage device **750** in FIG. **25**. This device **750** is in many ways identical to the device **700** in FIG. **24**. The time-stamping and authentication capabilities discussed in connection with FIG. **24** are also available and implemented in a similar way in the secure archival data storage device.

However, the device **750** differs in that it includes an archival storage medium, such as a high capacity disk drive and controller **752**, connected through a second I/O port **754** to an I/O device **756**. In the device **750** the seal **734** encloses also the disk-drive and controller **752** to prevent physical access to the archival files of FIG. **4**. As in the authentication/encryption device **700** of FIG. **25**, the microprocessor **708** also examines all commands from the CPU **702** as data to ensure that they conform to a list of valid commands stored in ROM **710**. A record is kept in non-volatile RAM **720** of locations on the hard disk where-the reference data **226**, FIG. **4**, previously written are located. A command to write to these locations is not permitted. (Of course, should the disk be a WORM optical disk instead of a magnetic disk, as in this embodiment, it would be unnecessary to include this restriction.)

To further enhance the security of the embodiment using the secure archival memory system in FIG. **25**, the software code which examines retrieved text to ensure that only data with the proper passwords are available to user (discussed above in connection with retrieval step **580** in FIG. **21**) is replaced with similar code in the ROM **710** and used to delete data returned from the disk which is in compartments for which passwords have not been received from the CPU **702**. This ensures that such data never leaves the protected and secure archival memory device consisting of the disk drive and controller **752** together with the authentication/encryption device **750** within the physical seal **734**, unless the appropriate passwords have been input. The code discussed in reference to step **580** in FIG. **21** is thus transferred from the diary object code of FIG. **3** to the ROM **710** in the embodiment in which the secure archival memory device is used.

Also, since the device **750** protects the data from those who do not have knowledge of the passwords, and also protects the reference data from alteration even by the diarist, it is no longer necessary to encrypt the data or the index before it is archived; and correspondingly no longer necessary to decrypt it upon retrieval. So these functions of the software and hardware which have previously been discussed can be removed from the diary software and hardware.

The above described software and/or hardware forming a personal computer diary is designed to be incorporated in any conventional computer including conventional personal desktop, laptop and notebook computers. Additionally the disclosed personal computer diary can be incorporated in a special purpose personal computer similar to a conventional notebook computer, but limited to use as a personal diary with seals enclosing the clock, disk or other permanent storage, encryption circuitry, and input/output circuitry. The special purpose diary computer can be provided with built-in public/private key time stamping and/or encryption facilities.

Since many modifications, variations and changes in detail can be made to the above described embodiments without departing from the scope and spirit of the invention, it is intended that the above description and the accompanying drawings be interpreted as only illustrative and not in a limiting sense.

What is claimed is:

1. A method for controlling operation of a user of a user device, comprising the steps of:

(a) issuing an authenticated time signal request from the user device to an authenticated time source device;

(b) generating an authenticated time signal within the authenticated time source device in response to the request;

(c) receiving the authenticated time signal at the user device;

(d) determining, within the user device, the validity of the authenticated time signal;

(e) controlling operation of the user device based on receipt of the authenticated time signal.

2. A method for controlling operation of a user device as recited in claim 1 wherein the step of issuing the authenticated time signal request further comprises the steps of generating a random or pseudorandom number within the user device; and transmitting the random or pseudorandom number from the user device to the authenticated time source device.

3. A method for controlling operation of a user device as recited in claim 1 wherein the step of generating the authenticated time signal comprises the steps of: determining a current time; performing a cryptographic operation on at least the current time to form an authentication code; and combining at least the current time and the authentication code to produce the authenticated time signal.

4. A method for controlling operation of a user device as recited in claim 3 wherein the step of performing the cryptographic operation further comprises hashing.

5. A method for controlling operation of a user device as recited in claim 3 wherein the step of performing the cryptographic operation comprises using a symmetric or asymmetric cryptographic key protocol.

6. A method for controlling operation of a user device as recited in claim 1 wherein the step of determining the validity of the authenticated time signal further comprises the steps of determining a previous time at which the user device was most recently stopped or started; determining a returned time from the authenticated time signal; and verifying that the returned time is later than the previous time.

7. A method for controlling operation of a user device as recited in claim 1 wherein the step of determining the validity of the authenticated time signal comprises the steps of: determining, from the authenticated time signal, at least a returned time and a returned authentication code; performing a cryptographic operation on at least the returned time to form a recomputed authentication code; and comparing the recomputed authentication code and the returned authentication code.

8. A method for controlling operation of a user device as recited in claim 7 wherein said performing the cryptographic operation comprises hashing.

9. A method for controlling operation of a user device as recited in claim 1 wherein the step of determining validity of the authenticated time signal further comprises the steps of: determining a random or pseudorandom number that was most recently transmitted to the authenticated time source; determining a returned random or pseudorandom number from the authenticated time signal; and comparing the returned and most recent random or pseudorandom numbers.

10. A method for controlling operation of a user device as recited in claim 1 wherein the step of controlling operation of the user device comprises setting a clock within the user device upon receipt of a valid authenticated time signal.

11. A method for controlling operation of a user device as recited in claim 1 wherein the step of controlling operation of the user device further comprises preventing continued operation of the user device in the absence of the valid authenticated time signal.

12. A method for controlling operation of a user device as recited in claim 7 wherein said performing the cryptographic operation includes using a cryptographic key.

13. A method for controlling operation of a user device as recited in claim 12 wherein the cryptographic key includes using a key belonging to a symmetric cryptographic protocol.

14. A method for controlling operation of a user device, comprising the steps of: issuing an authenticated time signal request to an authenticated time-source device; receiving an authenticated time signal from the authenticated time source device; determining the validity of the authenticated time signal; and controlling operation of the user device based on receipt of the authenticated time signal.

15. A method for controlling operation of a user device as recited in claim 14 wherein the step of issuing the authenticated time signal request comprises the steps of: generating a random or pseudorandom number within the user device; and transmitting the random or pseudorandom number from the user device to the authenticated time source device.

16. A method for controlling operation of a user device as recited in claim 14 wherein the step of determining the validity of the authenticated time signal comprises the steps of: determining a previous time at which the user device was most recently stopped or started; determining a returned time from the authenticated time signal; and verifying that the returned time is later than the previous time.

17. A method for controlling operation of a user device as recited in claim 14 wherein the step of determining validity of the authenticated time signal further comprises the steps of: determining, from the authenticated time signal, at least a returned time and a returned authentication code; performing a cryptographic operation on at least the returned time to form a recomputed authentication code; and comparing the recomputed authentication code and the returned authentication code.

18. A method for controlling operation of a user device as recited in claim 17 wherein the step of performing the cryptographic operation comprises hashing.

19. A method for controlling operation of a user device as recited in claim 14 wherein the step of determining the validity of the authenticated time signal further comprises the steps of: determining a random or pseudorandom number that was most recently transmitted to the authenticated time source; determining a returned random or pseudorandom number from the authenticated time signal; and comparing the returned and most recently transmitted random or pseudo random numbers.

20. A method for controlling operation of a user device as recited in claim 14 wherein the step of controlling operation of the user device comprises setting a clock within the user device upon receipt of the valid authenticated time signal.

21. A method for controlling operation of a user device as recited in claim 14 wherein the step of controlling operation of the device comprises preventing continued operation of the user device in the absence of a valid authenticated time signal.

22. A method for controlling operation of a user device as recited in claim 17 wherein said performing the cryptographic operation includes using a cryptographic key.

23. A method for controlling operation of a user device as recited in claim 22 wherein the cryptographic key is a key belonging to a symmetric cryptographic protocol.

24. A method for controlling operation of a user device as recited in claim 14 wherein the step of determining the validity of the authenticated time signal further comprises the step of performing a cryptographic operation on the authenticated time signal to give at least a returned time.

25. A method for controlling operation of a user device as recited in claim 24 wherein the step of performing a cryptographic operation includes using a cryptographic key.

26. A method for controlling operation of a user device as recited in claim 25 wherein the cryptographic key is a key used in a symmetric cryptographic protocol.

27. A method for controlling operation of a user device as recited in claim 25 wherein the cryptographic key comprises a key used in an asymmetric cryptographic protocol.

28. A method for controlling operation of a user device as recited in claim 14 wherein the step of determining the validity of the authenticated time signal further comprises the steps of:

determining a random or pseudorandom number that was most recently transmitted to the authenticated time source;

determining a returned random or pseudorandom number from the authenticated time signal; and

comparing the returned and most recently transmitted random or pseudorandom numbers.

29. A method for controlling operation of a user device as recited in claim 14 wherein the step of controlling operation of the user device comprises setting a clock within the user device after receipt of the valid authenticated time signal.

30. A method for controlling operation of a user device as recited in claim 14 wherein the step of controlling operation of the user device comprises preventing continued operation, of the user device unless the valid authenticated time signal is received.

31. An apparatus for controlling operation of a user device, comprising: an input/output port for issuing an authenticated time signal request to an authenticated time source and receiving an authenticated time signal from the authenticated time source; a memory; a controller for determining the validity of the authenticated time signal and for modifying operation of the user device in accordance with the validity determination; and a tamper resistance system for impeding unauthorized access to the user device.

32. An apparatus for controlling operation of a user device as recited in claim 31 additionally comprising a number generator for generating a random or pseudorandom number as part of the authenticated time signal request.

33. An apparatus for controlling operation of a user device as recited in claim 31 wherein said controller comprises:

a comparator for verifying that a returned time, determined from the authenticated time signal, is later than a previous time at which the user device was most recently stopped or started.

34. An apparatus for controlling operation of a user device as recited in claim 31 wherein said controller further comprises:

a cryptographic engine for determining a returned time and a returned authentication code from the authenticated time signal, and for performing a cryptographic operation on at least the returned time to form a recomputed authentication code; and

a comparator for comparing the recomputed authentication code and the returned authentication code.

35. An apparatus for controlling operation of a user device as recited in claim 34 wherein the computer engine includes means for computing a hash.

36. An apparatus for controlling operation of a user device as recited in claim 34 wherein the means for cryptographic engine includes at least a cryptographic key.

37. An apparatus for controlling operation of a user device as recited in claim 36 wherein the cryptographic key comprises a key used in a symmetric cryptographic protocol.

38. An apparatus for controlling operation of a user device as recited in claim 36 wherein the cryptographic key comprises a public key used in an asymmetric cryptographic protocol.

39. An apparatus for controlling operation of a user device as recited in claim 31 wherein said controller includes a comparator for comparing a first random or pseudorandom number that was most recently transmitted to the authenticated time source device against a second random or pseudorandom number returned from the authenticated time signal.

40. An apparatus for controlling operation of a user device as recited in claim 31 wherein said controller comprises means forgetting a clock within the user device upon receipt of a valid authenticated time signal.

41. An apparatus for controlling operation of a user device as recited in claim 31 wherein the controller for modifying operation of the user device comprises means for preventing continued operation of the user device in the absence of the valid authenticated time signal.

42. An apparatus for controlling operation of a user device as recited in claim 31 wherein the tamper resistance system comprises a seal enclosing a clock, a cryptographic engine, an input/output port, a digital bus, and the controller.

43. An apparatus as recited in claim 42 wherein said seal comprises an encapsulation.

44. An apparatus for controlling operation of a user device as recited in claim 31 wherein the tamper resistance system comprises means for allowing only predetermined electronic signals to access the user device.

45. An apparatus for controlling operation of a user device as recited in claim 31 wherein the tamper resistance system comprises means for automatically disabling the user device upon detection of unauthorized access.

46. An apparatus for controlling operation of a user device as recited in claim 31 wherein said controller further comprises a cryptographic engine for performing a cryptographic operation on the authenticated time signal to give at least a returned time.

47. An apparatus for controlling operation of a user device as recited in claim 46 wherein the cryptographic engine includes a cryptographic key.

48. An apparatus for controlling operation of a user device as recited in claim 47 wherein the cryptographic key is a key used in a symmetric cryptographic protocol.

49. An apparatus for controlling operation of a user device as recited in claim 47 wherein the cryptographic key is a key used in an asymmetric cryptographic protocol.

50. An apparatus for controlling operation of a user device as recited in claim 31 wherein said controller includes a comparator for comparing a first random or pseudorandom number that was most recently transmitted to the authenticated time source device against a second random or pseudorandom number returned from the authenticated time signal.

51. An apparatus for controlling operation of a user device as recited in claim 31 wherein the controller for modifying operation of the user device comprises means for setting a clock within the user device upon receipt of the valid authenticated time signal.

52. An apparatus for controlling operation of a user device as recited in claim 31 wherein the controller for modifying operation of the user device comprises means for preventing continued operation of the user device in the absence of the valid authenticated time signal.

53. An apparatus for controlling operation of a user device as recited in claim 31 wherein the tamper resistance system comprises a seal for enclosing: a clock, a cryptographic engine, an input/output port, a digital bus, and the controller.

54. An apparatus for controlling operation of a user device as recited in claim 53 wherein said seal comprises an encapsulation.

55. An apparatus for controlling operation of a user device as recited in claim 31 wherein the tamper resistance system comprises means for allowing only predetermined electronic signals to access the user device.

56. An apparatus for controlling operation of a user device as recited in claim 31 wherein the tamper resistance system comprises means for automatically disabling the user device upon detection of unauthorized access.

57. A device for authenticating and time-stamping input data, comprising:

a clock;

an encryption circuit including a secret key;

an input/output circuit including a port for receiving and transmitting digital signals;

a digital bus coupled to the input/output circuit, the encryption circuit, and the clock;

a controller coupled to the bus for controlling operation of said input/output circuit, said clock and said encryption circuit to receive input data and requests for authenticating and time-stamping the input data applied to the port, to read time data from the clock, to combine and input data with said time data, to operate the encryption circuit to generate an encrypted time stamp authentication code from the combined input data and time data, and to transmit from the port the time data and the encrypted time stamp authentication code; and

an access detector, said access detector indicating attempted access to at least one of said clock, said encryption circuit, said digital bus, said controller, and said input/output circuit except via the port.

58. A device for authenticating and time-stamping input data, comprising:

a clock;

an encryption circuit including a secret key;

an input/output circuit including a port for receiving and transmitting digital signals;

a digital bus coupled to the input/output circuit, the encryption circuit, and the clock;

a controller coupled to the bus for controlling operation of said input/output circuit, said clock and said encryption circuit to receive input data and requests for authenticating and time-stamping the input data applied to the port, to read time data from the clock, to combine and input data with said time data, to operate the encryption circuit to generate an encrypted time stamp authentication code from the combined input data and time data, and to transmit from the port the time data and the encrypted time stamp authentication code; and

an access inhibitor, said access inhibitor impeding access to said clock, said encryption circuit, said digital bus, said controller, and said input/output circuit except via the port.

59. A device for authenticating and time-stamping input data, comprising:

a clock;

an encryption circuit including a secret key;

an input/output circuit including a port for receiving and transmitting digital signals;

a digital bus coupled to the input/output circuit, the encryption circuit, and the clock;

a controller coupled to the bus for controlling operation of said input/output circuit, said clock and said encryption circuit to receive input data and requests for authenticating and time-stamping the input data applied to the port, to read time data from the clock, to combine and input data with said time data, to operate the encryption circuit to generate an encrypted time stamp authentication code from the combined input data and time data, and to transmit from the port the time data and the encrypted time stamp authentication code; and

a tamper resistance system, said tamper resistance system inhibiting undetected access to said clock, said encryption circuit, said digital bus, said controller, and said input/output circuit except via the port.

60. The device of claim 59 wherein said tamper resistance system comprises a seal enclosing said clock, said encryption circuit, said input/output circuit, said digital bus, and said controller.

61. The device of claim 59, wherein said tamper resistance system detects attempted access to at least one of said clock, said encryption circuit, said input/output circuit, said digital bus, and said controller.

62. The device of claim 59, wherein said tamper resistance system impedes access to at least one of said clock, said encryption circuit, said input/output circuit, said digital bus, and said controller.

63. The device of claim 59, wherein said tamper resistance system both detects attempted access to at least one of said clock, said encryption circuit, said input/output circuit, said digital bus, and said controller; and impedes access to at least one of said clock, said encryption circuit, said digital bus, said controller, and said input/output circuit except via the port.

64. The device of claim 59, wherein said tamper resistance system prevents undetected access to at least one of said clock, said encryption circuit, said input/output circuit, said digital bus, and said controller.

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